- estimated quantitation limit,
- practical quantitation limit,
- method detection limit, and
- IDL.

8. If during the investigation of COPCs in subsurface soil, it is determined by actual sampling that COPCs extend to the water table, groundwater beneath the site will be investigated for the presence of the COPCs.
9. If COPCs are identified in subsurface soil below 10 feet bgs, above background and action levels, but do not extend to the water table, then vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.
10. If it is determined that COPCs in subsurface soil have impacted groundwater causing exceedance of action levels, then the vertical and horizontal extent of groundwater exceedance will be evaluated.
13. If action levels or background concentrations are exceeded for the media of a site unit, then the risk assessment will be initiated, based on sample results, acceptable levels of risk, and potential land uses, to assess potential risks to human health and/or the environment.
14. If unacceptable risks are assessed to human health or the environment, then cleanup levels will be evaluated for each media.
15. If cleanup levels in a given media are exceeded, and if the site meets at least one of the eight criteria for removal action described in 40 *Code of Federal Regulations* 300.415(b)(2), and the scale and complexity of contaminant distribution in the affected media are such that excess risk can be expediently reduced utilizing readily available technology, then the media at the site will be recommended for Early Action.
16. If an early removal action is selected, a non-time-critical EE/CA and Action Memorandum will be completed for the removal action.
17. Once the removal action is completed, the site will be evaluated for residual risk. If a residual risk exists, then a Long-Term Action may be required.
18. If cleanup levels for a given media are exceeded, and if the site does not meet criteria for an Early Action, then the affected media will be recommended for Long-Term Remedial Action as part of the RI/FS process; and an FS will be completed, followed by a Record of Decision, Remedial Design, and Remedial Action to clean up the site for closure.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The purpose of Step 6 is to establish limits for decision errors, which are used by the decision makers to establish performance goals for the data collection design. The objective of the data collection design is to obtain data that reliably estimate the true nature of environmental conditions at Site 1. This process is presented in Section 4 of the Work Plan. The following information documents this process for Site 1.

### Identify the Null Hypothesis and Identify the Decision Errors

The null hypothesis for this site specifies that the concentrations of one or more of the COPCs exceed PRGs or risk-based action levels and represent an unacceptable risk at the site.

The alternative hypothesis for this site specifies that the concentrations of one or more of COPCs do not exceed PRGs or risk-based actions levels and represent an acceptable risk at the site.

The false-positive and false-negative decision errors are discussed in Section 4 of the Work Plan.

### Decision Error Limits

For the Phase II RI/FS, the allowable probability of making a false-positive decision has been designated as 0.05 (confidence of 95 percent), and an allowable probability of making a false-negative decision error has been designated as 0.20 (power of 80 percent).

### Calculating the Number of Samples Necessary to Determine Risk

The number of sample locations necessary to determine the risk at a unit or a site were estimated using the process presented in Section 4 of the Work Plan. The number of additional sample locations needed to assess risk during the Phase II RI/FS is the difference between the total number of sample locations and the number of locations sampled during the Phase I RI (Table A-1).

### Sampling Designs

An areal systematic random (grid) sampling design will be used to assess the soil conditions at Site 1. A description of this Phase II RI/FS sampling design is presented in Section 4 of the Work Plan. This sampling design utilizes random positioning to produce an unbiased configuration of sample locations. The advantage of a random, unbiased sampling design is that the tolerance limits for false-positive and false-negative decision errors can be applied to the sample data, and the risk decisions can be assigned a level of confidence.

## STEP 7 – OPTIMIZE THE DESIGN

Historic site activities, previous site investigation results, and regulatory comments were used to formulate the Phase II RI/FS sampling approach. Shallow and deeper subsurface soils will be investigated at this site using a tiered sampling approach. This sampling approach consists of three tiers.

## Table A-1
## Summary of Phase II RI/FS OU-3 Soil Sampling Strategies

| Description | Unit Area | Estimated Risk[a] | Maximum Number of Locations/ Samples[b] | Number of Phase I Locations/ Samples | Number of Phase II Locations/ Samples[b] | Tier | Type of Sampling Strategy |
|---|---|---|---|---|---|---|---|
| Site 1 – EOD Range | Unit 1–737,250 $ft^2$ | UNK (< 0.01) | 12(36) | 4(4) | 12(36) | 1 | Areal Systematic Random |
| | Unit 2–721,600 $ft^2$ | UNK (< 0.01) | 12(36) | 0 | 12(36) | 1 | Areal Systematic Random |

Notes:

[a] These estimated cancer risk values were developed using Phase I RI data, and COPC-specific risk-based concentrations were developed following completion of Phase I RI activities. UNK under this column signifies an unknown risk either because available sample data are insufficient or the unit is new and no samples have been collected. To be conservative, these unknowns were generally assigned an estimated risk of $10^{-5}$ to $10^{-6}$ to be confident of collecting sufficient samples.

[b] Maximum number of samples based on comparison of estimated cancer risk to Table 4-7 in Phase II RI/FS WP, which correlates four cancer-risk categories to the number of sample needed to determine that risk using the project-specific power and confidence limits. For this column, the first number represents sample locations, and the second number (in parentheses) is the number of samples based on an average of three depth intervals per sample location.

- The main focus of the Tier 1 sampling plan will be to determine whether the unit is a risk. The Tier 1 sampling approach will consist of collecting shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed such that when the Phase I and II RI/FS data are evaluated together, an assessment of risk can be completed for the unit.
- The Tier 2 sampling approach will also focus on shallow soil; however, the primary objective will be to refine the extent of shallow soil that has been impacted by site activities, by focusing on subareas of the unit where COPCs exceeded PRGs as identified by the Tier 1 sampling and/or Phase I RI/FS results.
- The Tier 3 sampling approach has been designed to estimate the horizontal and vertical extent of impacted subsurface soil (greater than 10 feet bgs). This sampling strategy will only be implemented if Phase I RI/FS soil sample analytical data or Phase II RI/FS Tier 1/Tier 2 soil sample analytical data suggest impacted soil exists at depths greater than 10 feet bgs. Groundwater will be investigated if Phase I or Phase II soil data indicate potential impacts to groundwater are possible.

The tiered sampling approach is detailed in the following sections and in the FSP, Attachment A (BNI 1995).

## Tier 1

The Tier 1 sampling will be collection of shallow samples from each unit within the site as described below. A summary of the number of sample locations, number of samples, and sample analyses is presented in Table A-2.

### TIER 1 SOIL SAMPLING

Tier 1 sample locations in both the units will be positioned in areal systematic random sampling locations based on a grid to characterize additional areas not sampled as part of the Phase I RI (Figure A-2).

#### *Unit 1: Northern EOD Range*

The objective of this investigation is to collect sufficient data to complete a risk assessment for this unit.

During the Phase I RI, three surface samples were collected and analyzed for VOC, SVOC, TRPH, TFH, TAL metals, general chemistry, dioxins, and furans in the area of Unit 1. COPCs detected in shallow soil included metals, nitrate/nitrite, TFH-gasoline, TFH-diesel, and TRPH. No COPCs found in soil exceeded PRGs or ecological screening criteria.

In the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at 12 areal systematic random sampling locations. Sample locations will be based on a grid with a spacing of 276 by 215 feet (Figure A-2). All soil samples will be field screened

## Table A-2
## Soil Sampling and Analysis

| | | PHASE II RI/FS SAMPLE NUMBERS | | | FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY | | | | OFF-SITE LABORATORY[b] |
|---|---|---|---|---|---|---|---|---|---|
| **Tier** | **Unit/Name** | **No. of Locations** | **Samples/ Location** | **Total Samples** | **PAH[c]** | **VOCs[d]** | **TPH Gas and Diesel[d]** | **Target Analyte List - Metals[d]** | **Others: Explosives, Dioxins/Furans Nitrate, and Tot. Phosphate** |
| Tier 1 | Unit 1 Northern EOD Range | 12 | 3 | 36 | X | X | X | X | X |
| | Unit 2 Southern EOD Range | 12 | 3 | 36 | X | X | X | X | X |
| *Tier 1 Subtotals* | | | | 72 | 72 | 72 | 72 | 72 | 72 |
| Tier 2 | Optional: Scope of Tier 2 would be to define extent of shallow soil contamination; based on Tier 1 data and Phase I RI findings, with approval of BCT | | | | | | | | |
| Tier 3 | Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data and Phase I RI findings, with approval of BCT | | | | | | | | |

Notes:
[a] for QA/QC support and verification eight samples from each unit will be submitted to an off-site laboratory for field screening confirmation
[b] these constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory
[c] immunoassay analyses
[d] mobile laboratory analyses

for polynuclear aromatic hydrocarbons (PAH) using immunoassay test kits (U.S. EPA Method 4035) and for benzene, toluene, ethylbenzene, and xylenes (BTEX) (U.S. EPA Method 8020), total petroleum hydrocarbons (TPH) (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) by an appropriately equipped mobile laboratory. In addition, all soil samples will be analyzed by a fixed-base laboratory for explosives (U.S. EPA Method 8330), dioxins and dibenzofurans (U.S. EPA Method 8280), nitrate (U.S. EPA Method 353.2), and phosphorous (U.S. EPA Method 365.2) under Naval Facilities Engineering Service Center (NFESC; formerly known as NEESA) Level D protocols. For quality assurance/quality control (QA/QC) support and verification, eight samples will be submitted to the fixed-base laboratory to confirm field screening results. The fixed-base laboratory analyses are PAH (U.S. EPA Method 8310), BTEX (U.S. EPA Method 8020), TPH (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under NFESC Level D protocols. Attachment A in the FSP provides the sampling procedures for the Phase II RI/FS at Site 1, Unit 1 (BNI 1995).

***Unit 2: Southern EOD Range***

The objectives of this investigation are to collect sufficient data to complete a risk assessment for this unit.

During the Phase I RI, no soil samples were located in the area of Unit 2. In the Phase II RI/FS, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at 12 areal systematic random sampling locations. Sample locations will be based on a grid with a spacing of 244 by 237 feet (Figure A-2). All soil samples will be field screened for PAH using immunoassay test kits (U.S. EPA Method 4035) and for BTEX (U.S. EPA Method 8020), TPH (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) by an appropriately equipped mobile laboratory. In addition, all soil samples will be analyzed by a fixed-base laboratory for analysis of explosives (U.S. EPA Method 8330), dioxins and dibenzofurans (U.S. EPA Method 8280), nitrate (U.S. EPA Method 353.2), and total phosphorous (U.S. EPA Method 365.2) under NFESC Level D protocols. For QA/QC support and verification, eight samples will be submitted to the fixed-base laboratory to confirm field screening results. The fixed-base laboratory analyses are PAH (U.S. EPA Method 8310), BTEX (U.S. EPA Method 8020), TPH (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under NFESC Level D protocols. Attachment A in the FSP provides the sampling procedures for the Phase II RI/FS at Site 1, Unit 2 (BNI 1995).

## Tier 2

The primary objective of the Tier 2 sampling program is to refine the extent of impacted soil defined within each unit by Phase I and/or II RI/FS sampling results. The Tier 2 sampling program will focus exclusively on shallow soil (0 to 10 feet depth) conditions and will further investigate subareas within the unit boundary that exceed PRGs.

The Tier 2 sampling plan may be developed after an evaluation of Phase I RI and/or Phase II RI/FS Tier 1 analytical results. The decision to proceed to Tier 2 will be based upon the criteria described in DQO Steps 2, 3, and 5. The proposed Tier 2 sampling plan, with recommendations, will be reviewed by the BCT. The BCT will decide whether the proposed Tier 2 sampling program will be implemented by the Navy.

### TIER 2 SOIL SAMPLING

The objective of a Tier 2 sampling program is to refine the extent of impacted shallow soil within the unit being investigated. The rationale for accomplishing this objective depends primarily on the size and layout of the unit. If the unit is a linear feature, such as a drainage ditch, the Tier 2 program will focus sampling along the trend of the ditch and will bracket the Tier 1 sampling locations (or Phase I RI/FS sample locations) where analyte concentrations exceed PRGs.

For units of rectangular, roughly circular, or irregular dimensions, areal systematic random sampling (grid) or judgmental sampling will be used to define the extent of the area surrounding Tier 1 sample locations where analyte concentrations exceeded PRGs. The area investigated using these sampling approaches will be contingent upon the distribution of adjacent Tier 1 sample locations where COPCs were not detected.

The number of Tier 2 sampling locations will be selected to achieve the following objectives:

- provide the areal coverage necessary to define the extent of shallow impacted soil, and
- minimize the cost associated with field and fixed-base laboratory sample testing.

The spacing between sampling locations for Tier 2 will be contingent upon the estimated size of the area to be investigated and the spacing between Phase I or II RI/FS sample locations. Tier 2 soil sample depth intervals and chemical analyses will conform to those specified for Tier 1 soil sampling.

## Tier 3

The objectives of the Tier 3 sampling program are to estimate the horizontal and vertical extent of impacted subsurface soil (greater than 10 feet bgs) and to assess whether groundwater beneath the site has been impacted by historic site activities. The Tier 3 sampling program would only be implemented at a unit if Phase I RI data or the initial evaluation of the Phase II RI Tier 1 and/or Tier 2 sampling program results suggest that soil contamination may extend to depths greater than 10 feet bgs. If impacted subsurface soil is limited to the vadose zone or vadose zone modeling does not suggest a potential for COPCs to impact groundwater, then groundwater will only be investigated if the interim groundwater monitoring data suggest that groundwater has been adversely impacted.

### TIER 3 SOIL SAMPLING

The Tier 3 soil sampling plan may be developed after an evaluation of Phase I RI and Phase II RI/FS l Tier 1 and/or Tier 2 analytical results. The decision to proceed will be based upon the criteria described in DQO Steps 2, 3, and 5. The proposed Tier 3 sampling plan, with recommendations, will be reviewed by the BCT. The BCT will decide whether the proposed Tier 3 sampling program will be implemented.

### TIER 3 GROUNDWATER SAMPLING

The Tier 1 soil sampling program will not begin until site closure. However, three groundwater monitoring wells are proposed for the site during the present field activities. The three wells will be monitored in conjunction with the two existing wells. The two wells constructed in the Phase I RI are located south of Site 1 in the assumed downgradient groundwater flow direction. Two of the three wells proposed for the Phase II RI/FS will be located in the northern portion (upgradient) of Site 1 and the third well will be located between the two upgradient and the two downgradient wells. These wells will allow for coverage of groundwater conditions at Site 1 while the site remains active. The estimated number of soil samples to be analyzed during borehole drilling operations and the proposed sample analyses are presented in Table A-3. Groundwater sample analyses are also presented in Table A-3.

The proposed wells will be constructed with 4-inch-diameter polyvinyl chloride casing and 4-inch stainless steel slotted screen with approximately 10 feet of slotted screen above the measured water table and approximately 20 feet below the present water table. Based on historic groundwater monitoring data, this construction design will allow for seasonal, as well as year-to-year, fluctuations in the water table. As outlined in the Tier 1 soil sampling program, soil samples will be collected every 5 feet commencing at the ground surface, and soil samples will be analyzed every 10 feet during construction of monitoring wells (BNI 1995).

## Optimization of Sampling Plan

As soil analytical data become available from sampling in each unit, sampling plans for the site will be optimized. The tiered sampling approach is an iterative process that will permit data from one tier to be evaluated prior to the implementation of the next tier of sampling. The iterative process involves review of the data, recommendations for further actions, and approval by BCT. The investigation will be optimized by performing the minimum amount of sampling needed to satisfy the decision making process regarding future actions (i.e., NFI, Removal Action, and Remedial Action) at the unit.

## Table A-3
## Soil Sampling and Analysis

| Media | PHASE II RI/FS SAMPLE NUMBERS | | FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY | | | | OFF-SITE LABORATORY[b] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | No. of Locations | Total Samples | PAH[c] | BETX[d] | TFH Gas and Diesel[d] | TAL - Metals[d] | PAH | BETX | TPH Gas and Diesel | TAL Metals | Explosives | Total Phosphate | Dioxins, Dibenzo-furans | Nitrate | General Chemistry |
| Soil | 3 | 45 | X | X | X | X | | | | | X | X | X | | |
| Ground-water | 5 | 5 | | | | | X | X | X | X | X | X | X | X | X |
| *Subtotals* | | 50 | 45 | 45 | 45 | 45 | 5 | 5 | 5 | 5 | 50 | 50 | 50 | 5 | 5 |

Notes:
[a] Approximately 20 percent of the samples will be submitted to an off-site laboratory for confirmation of the field screening results.
[b] For soil analyses, these constituents cannot be determined in the field, so the analyses will be performed in the off-site laboratory. For groundwater, all analyses will be performed at the off-site laboratory.
[c] immunoassay analyses
[d] mobile laboratory analyses

# References

Bechtel National, Inc. 1995. *Draft Field Sampling Plan Phase II Remedial Investigation/ Feasibility Study*. Marine Corps Air Station El Toro, California.

BNI. *See* Bechtel National, Inc.

Jacobs Engineering. *See* Jacobs Engineering Group, Inc.

Jacobs Engineering Group, Inc. 1991. *Geophysical Survey Report.* Marine Corps Air Station El Toro, California.

———. 1993a. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study Draft Sampling Analysis Plan*. Marine Corps Air Station El Toro, California.

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———. 1993c. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study, Draft Work Plan.* Marine Corps Air Station El Toro, California.

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———. 1994b. Interviews with active and retired personnel from Marine Corps Air Station El Toro, California.

———. 1995. *Draft Field Sampling Plan Phase II Remedial Investigation/Feasibility Study.* Marine Corps Air Station El Toro, California.

LUFT. *See* State of California Leaking Underground Fuel Tank Task Force.

SAIC. *See* Science Applications International Corporation.

Science Applications International Corporation. 1993. *Final Report Aerial Photograph Assessment, Marine Corps Air Station El Toro, El Toro, California*. Science Applications International Corporation.

State of California Leaking Underground Fuel Tank Task Force. 1989. *Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure.*

United States Environmental Protection Agency. 1993. *Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process.*

U.S. EPA. *See* United States Environmental Protection Agency.

# WORK PLAN APPENDIX B

## DATA QUALITY OBJECTIVES
## OPERABLE UNIT 2 –
## SITE 2 – MAGAZINE ROAD LANDFILL

# SUMMARY

## STEP 1 – STATE THE PROBLEM

The problem at Site 2, Magazine Road Landfill, is to 1) determine if the VOCs in groundwater present a risk, and if so, determine the level of action required to remediate the site, and 2) determine if the United States Environmental Protection Agency presumptive remedies for municipal landfills (which include capping, groundwater treatment, gas control and treatment, or deed restrictions) are appropriate.

## STEP 2 – IDENTIFY THE DECISION

The Phase II Remedial Investigation/Feasibility Study decisions to be considered at Site 2 are as follows: Are solid wastes exposed? Have the limits of landfilled wastes been defined? Are the action levels for ambient air exceeded? Has the landfill impacted surface water or sediment? Have principal waste "hot spots" been identified within the landfill? Do data indicate that leakage from the landfill has impacted groundwater? Do data indicate that leakage from the landfill has impacted the subsurface soil? Has the nature and vertical extent of chemicals of potential concern in groundwater been defined? Do data indicate that sensitive habitats have been impacted?

## STEP 3 – IDENTIFY THE INPUTS AFFECTING THE DECISION

Inputs necessary to make the decisions listed in Step 2 include a list of chemical constituents to be analyzed; a definition of the limits of solid waste; an assessment of potential hot spots and the nature and extent of chemicals of potential concern in groundwater; an identification of contamination source(s) for surface water, sediment, and landfill gas emission; and assessment of ecological risk to sensitive habitats.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

The study is geographically limited to the Magazine Road Landfill, the portion of Borrego Canyon Wash located on the landfill, and groundwater beneath the landfill.

## STEP 5 – DEVELOP A DECISION RULE

Action levels developed for decision-making purposes are a cumulative excess cancer risk of $10^{-6}$ in humans, a hazard index of 1.0 for chronic systemic toxicity in humans, and a hazard index of 1.0 for acute and chronic toxicity for other organisms in the environment. Based on these risk levels, decision rules are developed to protect human health and the environment in residential, industrial, and recreational land use scenarios.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The sampling designs proposed for Site 2 are areal systematic random sampling and judgmental sampling. An areal systematic random sampling design will be used to characterize the nature and extent of a problem and detect hot spots. The initial round of sampling will be on a 100-foot grid spacing, providing an 80-percent confidence of hitting a circular hot spot having a radius of 50 feet. Judgmental sample locations will be based on previous data and regulatory guidelines.

## STEP 7 – OPTIMIZE THE DESIGN

Samples to be collected for the Phase II will support the remedial action for municipal landfill sites. Generally, activities to be performed will include surface geophysics, soil gas sampling, air sampling, vadose zone sampling, groundwater sampling, well installation, and ecological risk assessment sampling.

# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| Air SWAT | Air Quality Solid Waste Assessment Test |
| bgs | below ground surface |
| BCP | BRAC Cleanup Plan |
| BRAC | Base Realignment and Closure |
| CFR | *Code of Federal Regulations* |
| COPC | chemical of potential concern |
| DDD | dichlorodiphenyldichloroethane |
| DDE | dichlorodiphenyldichloroethene |
| DDT | dichlorodiphenyltrichloroethane |
| DQO | data quality objective |
| EM | electromagnetic |
| FMD | Facility Management Department |
| FS | Feasibility Study |
| FSP | Field Sampling Plan |
| Kd | equilibrium constant |
| MCAS | Marine Corps Air Station |
| MCPA | 2-methyl-4-chlorophenoxyacetic acid |
| MCPP | 2-(2-methyl-4-chlorophenoxy)-propionic acid |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| ND | nondetect |
| NFI | No Further Investigation |
| $\%_V$ | percent by volume |
| PCE | tetrachloroethene |
| pCi/L | picocuries per liter |
| $ppb_v$ | parts per billion by volume |
| $ppm_v$ | parts per million by volume |
| PRG | (U.S. EPA Region IX) Preliminary Remediation Goal |
| R | retardation factor |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |

# ACRONYMS/ABBREVIATIONS (continued)

| | |
|---|---|
| RWQCB | (California) Regional Water Quality Control Board |
| SAIC | Science Applications International Corporation |
| SCAQMD | South Coast Air Quality Management District |
| SVOC | semivolatile organic compound |
| TAL | target analyte list |
| TCE | trichloroethene |
| TDS | total dissolved solids |
| TFH | total fuel hydrocarbons |
| TOC | total organic carbon |
| TRPH | total recoverable petroleum hydrocarbons |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |

## Appendix B
# SITE 2 – MAGAZINE ROAD LANDFILL

The United States Environmental Protection Agency (U.S. EPA) developed the data quality objectives (DQO) process as a tool for project managers to determine the type, quantity, and quality of data needed to make decisions. Data produced by sampling and monitoring activities are used extensively in problem definition, rule-making, and enforcement decisions. These activities are supported through implementation of the mandatory U.S. EPA Quality System, which requires all organizations to develop and operate management processes and structures for assuring that the data collected are of the necessary and expected quality for their desired use (U.S. EPA 1993a).

The U.S. EPA DQO process consists of the following seven steps:

1. **State the problem:** Describe the problem at the site as it is currently understood. The problem statement includes a site conceptual model and an organization and review of all relevant data.
2. **Identify the decision:** Determine an if-then statement that will define what the investigation will seek to determine and what actions will be taken based on the possible outcomes of the investigation.
3. **Identify inputs into the decision:** Specify the analytes or parameters to be measured and used.
4. **Define the study boundary:** Delineate the study boundary from information obtained from Step 1.
5. **Develop a decision rule:** Restate the decision detailing the if-then statement in specific terms.
6. **Specify acceptable limits on decision errors:** Specify how the data will be treated statistically and what the acceptable limits of uncertainty are.
7. **Optimize the design:** Design the field investigation, giving adequate consideration to the results of Steps 5 and 6. This step is described in more detail in the Field Sampling Plan (FSP).

The following sections describe the DQO process for Site 2 – Magazine Road Landfill.

## STEP 1 – STATE THE PROBLEM

A review of groundwater quality analytical data indicates that groundwater beneath the Magazine Road Landfill has been contaminated from historic waste disposal at the site (Jacobs Engineering 1993a). Volatile organic compounds (VOCs) detected in groundwater may extend downgradient to Site 5, Perimeter Road Landfill. Previous data also indicate that the landfill gas contains up to 45 percent methane (by volume) (Strata 1991). The problem at Site 2, Magazine Road Landfill, is to 1) determine if the VOCs in groundwater present a risk and, if so, determine the level of action required to remediate the level of action required to remediate the site, 2) determine appropriate remedial responses and, in particular, if the U.S. EPA presumptive remedies (which include capping, groundwater treatment, gas control and treatment, or deed restrictions) are appropriate, and 3) assess ecological impacts and determine appropriate remedial response to mitigate ecological impacts from the landfill.

## Site Description

Site 2 occupies approximately 22 acres between Borrego Canyon Wash and one of its tributaries in an area that was originally used as a gravel borrow pit (Figure B-1). The Magazine Road Landfill was used from the late 1950s until about 1980, although some unauthorized disposal may have occurred on an intermittent basis until recently. During the 1970s, all solid waste from Marine Corps Air Station (MCAS) El Toro, and some waste from MCAS Tustin, were disposed in this landfill. Previous reports estimate that between 800,000 and 1,000,000 cubic yards of waste were placed in the landfill during its operational life (Strata 1991). Wastes were placed in the old borrow pit which was backfilled in a series of lifts; they were not burned for volume reduction. The remains of this pit are visible as a depression at the upper end of a man-made drainage channel that bisects the site.

The Magazine Road Landfill site is situated in the foothills of the Santa Ana Mountains at an elevation of about 500 feet mean sea level. Because it is located in a wash, infiltration of surface water occurs at this site. There are no current landfill activities at the site, and the landfill has become overgrown with chaparral. Soil cover of unknown thickness has been placed over the landfill. The suspected types of waste include construction debris, municipal waste, batteries, waste oils, hydraulic fluids, paint residues, transformers, and waste solvents.

## Previous Investigations

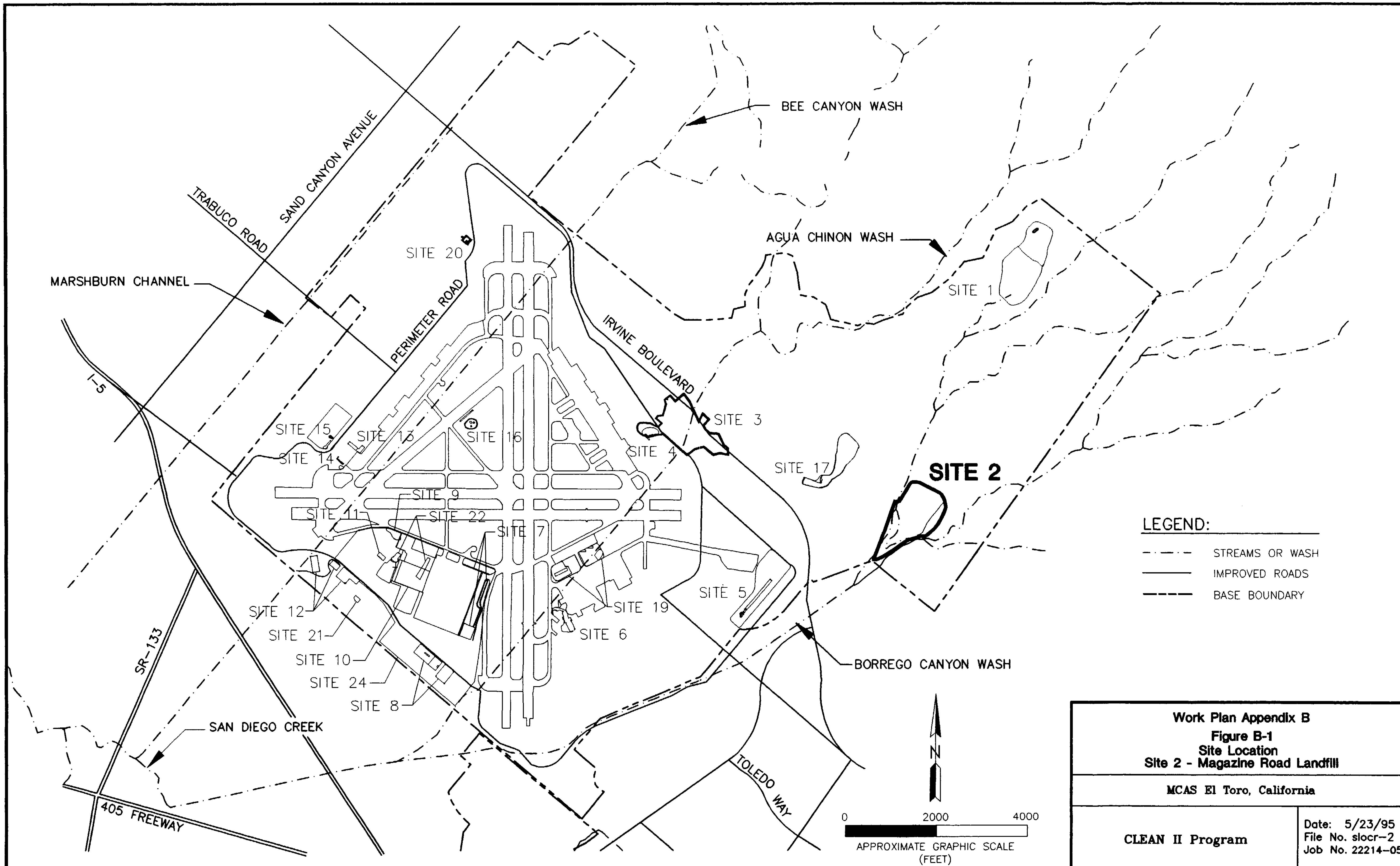
The previous investigations include the following: the Phase I Remedial Investigation (RI), employee interviews, U.S. EPA aerial photographic survey, Science Applications International Corporation (SAIC) aerial photographic survey, and the Air Quality Solid Waste Assessment Test (Air SWAT). These investigations are summarized below. The locations of Phase I investigations are shown on Figure B-2.

## Phase I Remedial Investigation

For the Phase I RI, subareas within sites were designated as strata. Due to the fact that some new subareas have been added or subareas have been expanded or added for the Phase II RI/Feasibility Study (FS), subareas within sites will be referred to as units for the Phase II RI/FS. In this section, discussion is related to Phase I RI sampling and results and the term strata will be used. Following this section, the term unit will be used.

The activities conducted as part of its Phase I RI included:

- collecting shallow soil samples from seven locations (three each from Strata 1 and 2, and one upgradient);
- drilling and sampling one deep boring;
- drilling, installing, and sampling one upgradient monitoring well;




**Work Plan Appendix B**
**Figure B-1**
**Site Location**
**Site 2 - Magazine Road Landfill**

**MCAS El Toro, California**

**CLEAN II Program**

Date: 5/23/95
File No. slocr-2
Job No. 22214-059

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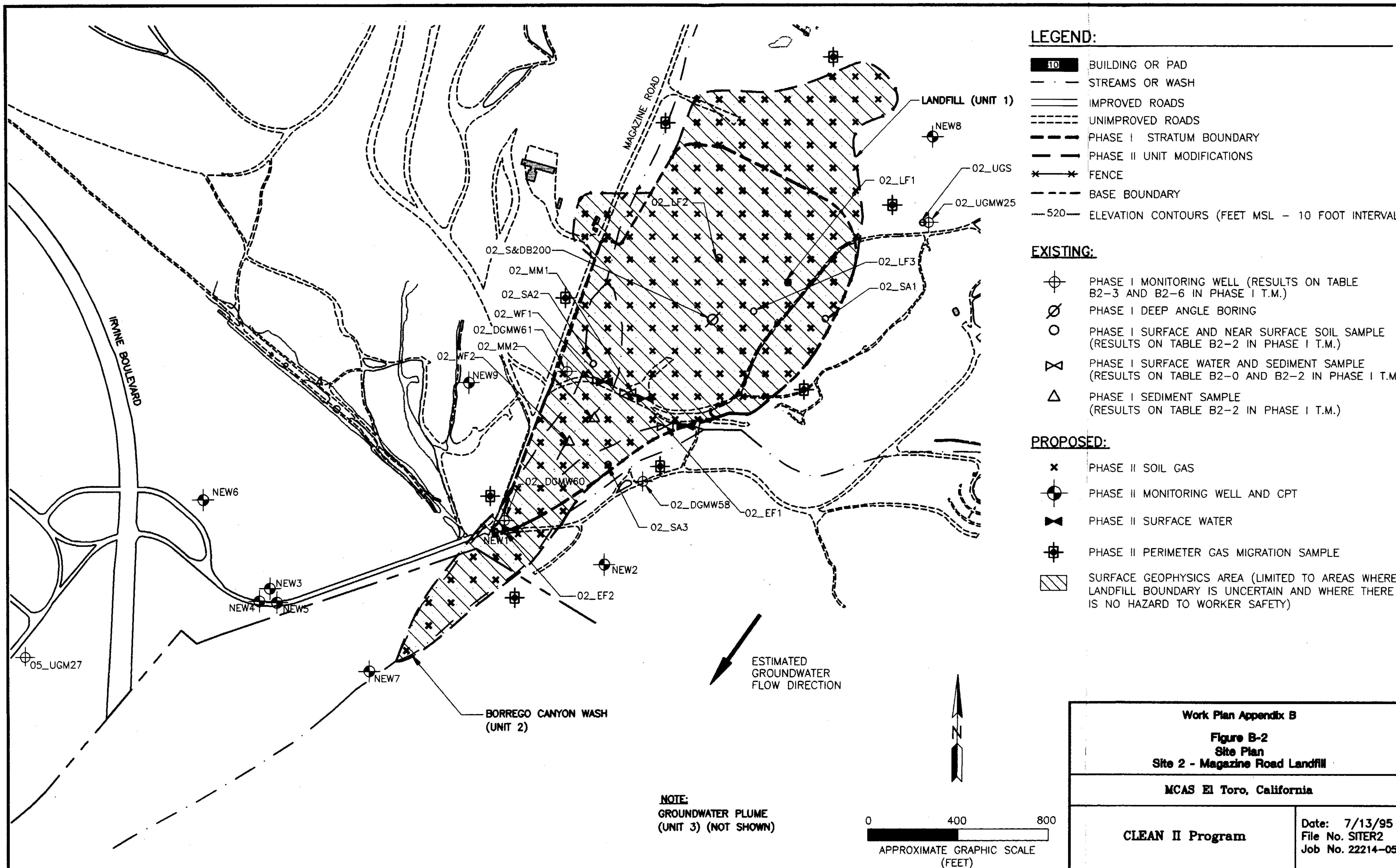
LEGEND:
BUILDING OR PAD
STREAMS OR WASH
IMPROVED ROADS
UNIMPROVED ROADS
PHASE I STRATUM BOUNDARY
PHASE II UNIT MODIFICATIONS
FENCE
BASE BOUNDARY
520 ELEVATION CONTOURS (FEET MSL – 10 FOOT INTERVAL)
EXISTING:
PHASE I MONITORING WELL (RESULTS ON TABLE B2-3 AND B2-6 IN PHASE I T.M.)
PHASE I DEEP ANGLE BORING
PHASE I SURFACE AND NEAR SURFACE SOIL SAMPLE (RESULTS ON TABLE B2-2 IN PHASE I T.M.)
PHASE I SURFACE WATER AND SEDIMENT SAMPLE (RESULTS ON TABLE B2-0 AND B2-2 IN PHASE I T.M.)
PHASE I SEDIMENT SAMPLE (RESULTS ON TABLE B2-2 IN PHASE I T.M.)
PROPOSED:
PHASE II SOIL GAS
PHASE II MONITORING WELL AND CPT
PHASE II SURFACE WATER
PHASE II PERIMETER GAS MIGRATION SAMPLE
SURFACE GEOPHYSICS AREA (LIMITED TO AREAS WHERE LANDFILL BOUNDARY IS UNCERTAIN AND WHERE THERE IS NO HAZARD TO WORKER SAFETY)
LANDFILL (UNIT 1)
MAGAZINE ROAD
IRVINE BOULEVARD
NEW8
02_UGS
02_LF1
02_UGMW25
02_LF2
02_LF3
02_SA1
02_S&DB200
02_MM1
02_SA2
02_WF1
02_DGMW61
02_MM2
02_WF2
NEW9
NEW6
02_DGMW60
02_DGMW58
02_EF1
02_SA3
NEW1
NEW2
02_EF2
NEW3
NEW4
NEW5
05_UGM27
NEW7
BORREGO CANYON WASH (UNIT 2)
ESTIMATED GROUNDWATER FLOW DIRECTION
N
NOTE: GROUNDWATER PLUME (UNIT 3) (NOT SHOWN)
0
400
800
APPROXIMATE GRAPHIC SCALE (FEET)
Work Plan Appendix B
Figure B-2
Site Plan
Site 2 - Magazine Road Landfill
MCAS El Toro, California
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Date: 7/13/95
File No. SITER2
Job No. 22214-059

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- drilling, installing, and sampling three downgradient wells;
- collecting dry-wash sediment samples from six locations in Borrego Canyon Wash; and
- collecting surface water runoff samples from four locations in Borrego Canyon Wash.

A summary of the Phase I RI analytical results and groundwater monitoring is presented below. The summary includes minimum and maximum detected concentrations for each chemical listed. The minimum concentration is recorded as less that the detection limit if the chemical constituent was not detected. Metal concentrations are listed only if they exceeded U.S. EPA Region IX Preliminary Remediation Goals (PRGs) or ecological screening criteria (Jacobs Engineering 1993b, Tables A2-1a, A2-1d, and A2-1e). Target analyte list (TAL) metals that were analyzed during the Phase I RI are arsenic, aluminum, antimony, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

### *Surface Water*

Surface water samples were collected during three storm events: two events in March 1992 and one event in December 1992.

- metals: 15 of 23 TAL metals; and
- VOCs: acetone (< 2 to 6 micrograms per kilogram [μg/kg]).

### *Sediment*

- VOCs: acetone (< 10 to 8J μg/kg [02_MM2 at 0 feet]), toluene (< 10 to 4J μg/kg [02_WF2 at 0 feet]), benzene (< 10 to 4J μg/kg [02_WF2 at 0 feet]), carbon tetrachloride (< 10 to 11 μg/kg [02_MM2 at 0 feet]), methylene chloride (< 11 to 92 μg/kg [02_MM2 at 0 feet]), trichloroethene (< 10 to 3J μg/kg [02_WF2 at 0 feet]);
- semivolatile organic compounds (SVOCs): benzyl butyl phthalate (< 670 to 1,200 μg/kg [02_MM1 at 4 feet]), bis(2-ethylhexyl) phthalate (< 670 to 350J μg/kg [02_MM1 at 2 feet]);
- herbicides: 2-(2-methyl-4-chlorophenoxy)-propionic acid (MCPP) (< 24,400 to 140,000 μg/kg [02_WF2 at 2 feet]), 2,4-DB (< 48.8 to 455 μg/kg [02_WF2 at 2 feet]);
- pesticides and polychlorinated biphenyls (PCBs): 4,4'-dichlorodiphenyltrichloroethane (DDT) (< 3.3 to 5.04 μg/kg [02_WF2 at 2 feet]), alpha-chlordane (< 1.7 to 2.4 μg/kg [02_MM2 at 0 feet]), gamma-chlordane (< 1.71 to 2.35 μg/kg [02_MM2 at 0 feet]); and
- fuel and petroleum hydrocarbons: total fuel hydrocarbons (TFH)-gasoline (< 0.051 to 0.064 milligrams per kilogram [mg/kg] [02_WF2 at 2 feet]), total recoverable petroleum hydrocarbons (TRPH) (< 20 to 4,555 [02_EF2 at 4 feet] mg/kg).

### *Shallow Soil*

- VOCs: 2-hexanone (< 10 to 17 µg/kg [02_LF3 at 0 feet]), 2-butanone (< 10 to 4J µg/kg [02_SA2 at 2 feet]), acetone (< 10 to 32 µg/kg [02_SA3 at 0 feet]), toluene (< 10 to 15 µg/kg [02_S&DB 200 at 0 feet]), 4-methyl-2-pentanone (< 10 to 5J µg/kg [02_LF2 at 0 feet]), xylenes (< 10 to 6J µg/kg [02_LF3 at 0 feet]), ethylbenzene (< 10 to 6J µg/kg [02_LF3 at 0 feet]);
- SVOCs: benzyl butyl phthalate (< 670 to 150J µg/kg [02_SA2 at 2 feet]);
- herbicides: MCPP (< 25,400 to 48,700 µg/kg [02_S&DB 200 at 0 feet]), dalapon (< 50.7 to 81.5 µg/kg [02_S&DB 200 at 0 feet]), dichloroprop (< 101 to 507 µg/kg [02_SA2 at 0 feet]);
- pesticides and PCBs: aldrin (< 1.7 to 3.01J µg/kg [02_SA3 at 0 feet]), 4,4'-DDT (< 3.3 to 18.2 J µg/kg [02_SA3 at 0 feet]), 4,4-dichlorodiphenyldichloroethane (DDD) (< 3.35 to 0.839J µg/kg [02_SA3 at 0 feet]), 4,4'-dichlorodiphenyldichloroethene (DDE) (< 3.35 to 4.45J µg/kg [02_SA3 at 0 feet]); and
- fuel and petroleum hydrocarbons: TFH-gasoline (< 0.05 to 0.958 mg/kg [02_SA3 at 4 feet]), TFH-diesel (< 12.4 to 97.5 mg/kg [02_SA3 at 4 feet]).

### *Subsurface Soil*

- VOCs: toluene (< 10 to 7J µg/kg [02_S&DB 200 at 35 feet]), acetone (< 10 to 90 µg/kg [02_UGMW 25 at 60 feet]);
- SVOCs: bis(2-ethylhexyl) phthalate (< 680 to 360J µg/kg [02_DGMW 59 at 48 feet]); and
- herbicides: dalapon (< 50.9 to 82.7 µg/kg [02_S&DB 200 at 15 feet]), 2,4-DB (< 50.9 to 198 µg/kg [02_UGMW 25 at 50 feet]), 2-methyl-4-chlorophenoxyacetic acid (MCPA) (< 25,400 to 225,000 µg/kg [02_UGMW 25 at 50 feet]).

### *Groundwater*

- VOCs: chloroform (< 1 to 6 µg/L), 1,2-dichloroethane (< 1 to 0.9J µg/L), 1,2-dichloroethene (< 1 to 8 µg/L), tetrachloroethene (< 1 to 8 µg/L), trichloroethene (0.6J to 82 µg/L), 1,1,2-trichloroethane (< 1 to 2 µg/L); and
- gross alpha and gross beta: gross alpha (6.5 to 24 picocuries per liter [pCi/L]), gross beta (5.2 to 30.2 pci/L).

J = Indicates an estimated value for qualitative use only (organic parameters).

## SUMMARY OF EMPLOYEE INTERVIEWS

On 26 May 1994, a meeting was held at MCAS El Toro to interview active and retired personnel from the Fuel Operations Division and Facility Management Department (FMD) (currently the Installations Department) the operations and procedures of storage/disposal of hazardous materials and waste at the Station (Jacobs Engineering 1994). Participating as interviewers during the meeting were agency personnel, Navy and Station personnel, and personnel from the contractors for the Navy and the U.S. EPA. A synopsis of the Site 2 discussion follows.

- All panel members agreed that the boundaries of the site, as illustrated in the Base Realignment and Closure (BRAC) Cleanup Plan (BCP) figure, encompass an area slightly larger than the actual disposal area.
- The boundaries northeast of the access road appear to be accurate. The area south of the access road was never used for disposal purposes. The panel agreed that the southwest boundary could be redrawn along the access road.
- Possibly two or three drums of waste fluids were disposed into the landfill at any given time. The panel members were unable to estimate a total volume that may have been disposed into the landfill.
- Contaminated soil was excavated from Site 8 and transported to Site 2.
- During grading activities for tarmac expansion at Site 10, dark, petroleum-contaminated soil was encountered. This soil was excavated and transported to the landfarm area northwest of Bee Canyon Wash and subsequently to the Magazine Road Landfill.
- Site 2 was a common disposal area for excess sludge.
- The panel members had no knowledge of radioactive material being disposed into any of the landfills by the FMD. However, they were not aware of all disposal activities that may have been conducted by the Marines.
- Burn pit activities occurred at Site 2 on only a few occasions.

## U.S. EPA SURVEY

During the Phase I RI, the U.S. EPA aerial photography analysis was reviewed to evaluate the existing site boundaries (Jacobs Engineering 1993a). Activities at Site 2 were first identified in the 1959 aerial photograph. The photograph shows a large borrow pit in the middle of the site and two fill areas with light-toned, mounded material along Magazine Road, north and south of the landfill access road. The 1965 photograph shows refuse east of Magazine Road and north of the access road, and trenches and mounded material south of the access road. In the 1970 photograph, disposal activities (refuse, debris, trenches and staining) were noted for the first time within the borrow pit, which had increased in size since 1959. This photograph also shows debris, liquid, mounded material, and stained areas on the east side of the access road. By 1980, activities at the landfill and surrounding areas had declined significantly. The large borrow pit was filled and vegetated. Mounded material in an open-ended trench and numerous stains are visible within the landfill. In the 1981 photograph, U.S. EPA observed a trench surrounded by berms approximately 600 feet north of the landfill. Landfill activities continued through 1991 in the landfill north and south of the access road. In the 1989 photograph, liquid appears east of the access road. The 1991 photograph shows some activity, consisting of a small pit and debris.

## SCIENCE APPLICATIONS INTERNATIONAL CORPORATION SURVEY

The Science Applications International Corporation review of historical aerial photography detected initial activities at the landfill in the 1958 photograph, including minor ground scarring, three unidentified objects, and a trench in the eastern portion of the landfill. The 1968 photograph shows a large extraction area/borrow pit in the central portion of the landfill, and a fill area along Magazine Road south of the access road. SAIC identified a trench at the site in 1971 approximately 600 by 70 feet in area that may have contained liquid (SAIC 1993).

## AIR SWAT

The following activities were conducted as part of the Air SWAT (Strata 1991):

- landfill gas sampling,
- ambient air sampling,
- integrated surface sampling, and
- landfill gas migration testing.

A summary of the Air SWAT analytical results is presented below. The Air SWAT report did not quantify compound detection limits. If the compound was not detected, it was reported as nondetected (ND).

### *Landfill Gas*

- VOCs: dichloromethane (ND to 460 parts per billion by volume [$ppb_v$]), chloroform (ND to 21 $ppb_v$), benzene (ND to 330 $ppb_v$), trichloroethene (ND to 150 $ppb_v$), tetrachloroethene (ND to 140 $ppb_v$); and
- other gases: methane (2.3 to 45 percent by volume [$\%_v$]), carbon dioxide (19 to 35 $\%_v$).

### *Ambient Air*

- VOCs: dichloromethane (ND to 4.8 $ppb_v$), 1,1,1-trichloroethane (ND to 2.5 $ppb_v$), tetrachloroethene (ND to 0.53 $ppb_v$).

### *Integrated Surface Sampling*

- total organic carbon (TOC) as methane (2.9 parts per million by volume [$ppm_v$]).

### *Landfill Gas Migration Sample Points*

- TOC (5.2 to 25,000 $ppm_v$).

## Geology

Boring logs from the Phase I RI indicate that the subsurface soil consists of sand, sand with gravel, silty sand, sandy silt, and silty sand with gravel. Occasional layers of silt and clay were also found. This alluvial material rests upon semiconsolidated sandstone and siltstone at shallow depths. Bedrock was encountered in well boring 02_DGMW60 at approximately 60 feet below ground surface (bgs) (Jacobs Engineering 1993a).

## Hydrogeology

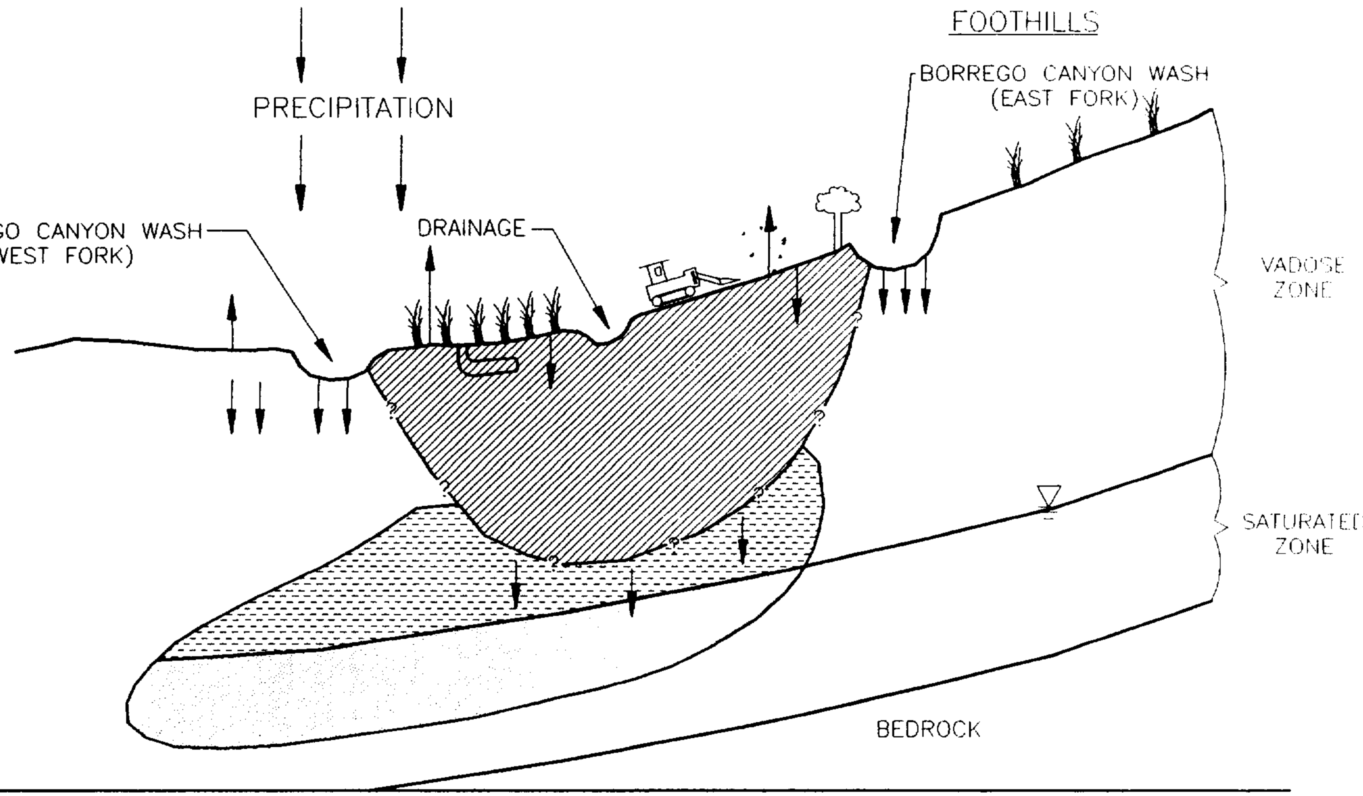
The Magazine Road Landfill is situated between Borrego Canyon Wash and one of its tributaries. The sandy soil that characterizes Site 2 is permeable to infiltrating surface water. Wide fluctuations in the depth to groundwater occur in response to storm events. In addition, groundwater flow may be affected by a fault that crosses Site 2. Groundwater lies at depths ranging from 10 to 70 feet bgs. The groundwater flow direction appears to be southwesterly along the axis of the wash, although some variation (southwesterly to westerly) has been observed (Jacobs Engineering 1993a).

## Conceptual Site Model

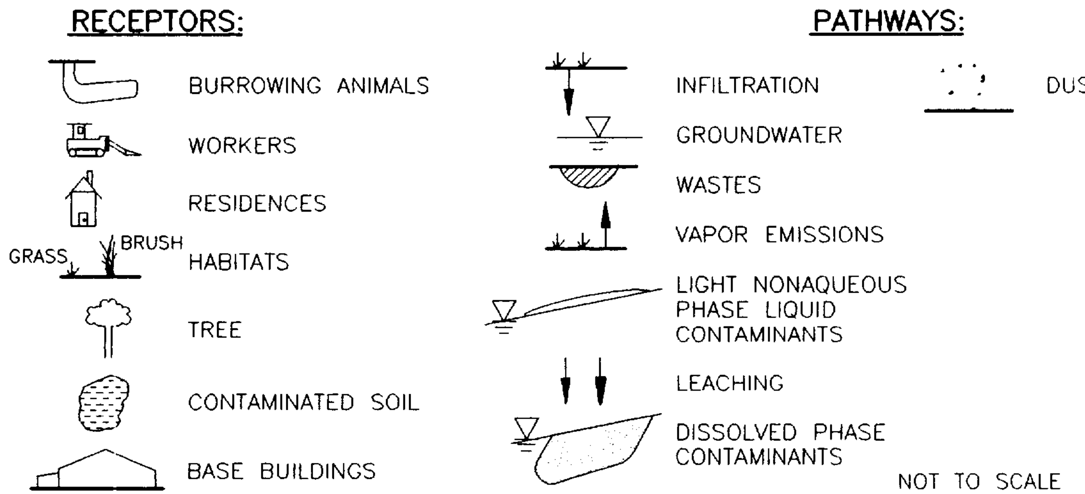
In the process of developing a conceptual site model, response mechanisms (both primary and secondary) and potential sources of contamination were considered and evaluated to determine their applicability to the site. Also considered in the development of the conceptual site model were potential receptors and contaminant pathways to potential receptors. Figure B-3 illustrates the conceptual site model developed for the site. Figure B-4 depicts the potential exposure routes and pathways for human and ecological receptors.

The primary release mechanism is the surficial release of contaminants to shallow soil resulting from historic waste disposal activities at this site. Eventually under gravity, contaminants present in shallow soil may move downward with soil moisture (in dissolved phase) or in a liquid phase. Because this site contains a variety of wastes, the wastes potential mobility in the environment is could be significant. The depth of groundwater is recorded to be about 40 to 100 feet bgs.

The secondary source of contaminants is the surrounding soil impacted by disposal activities. The secondary release mechanism is the dust brought into suspension in the air. The fine particles of dust may contain all potential contaminants. Storm water runoff may form another secondary release mechanism. Storm water carries contaminants in dissolved forms, colloidal forms, or associated with suspended soil particles that may be carried with storm water runoff into the on-site, unlined channel or Borrego Canyon Wash or are present in surface water and sediments.




LEGEND:




NOT TO SCALE

**Work Plan Appendix B**

**Figure B-3**

**Conceptual Site Model**

**Site 2 - Magazine Road Landfill**

MCAS El Toro, California

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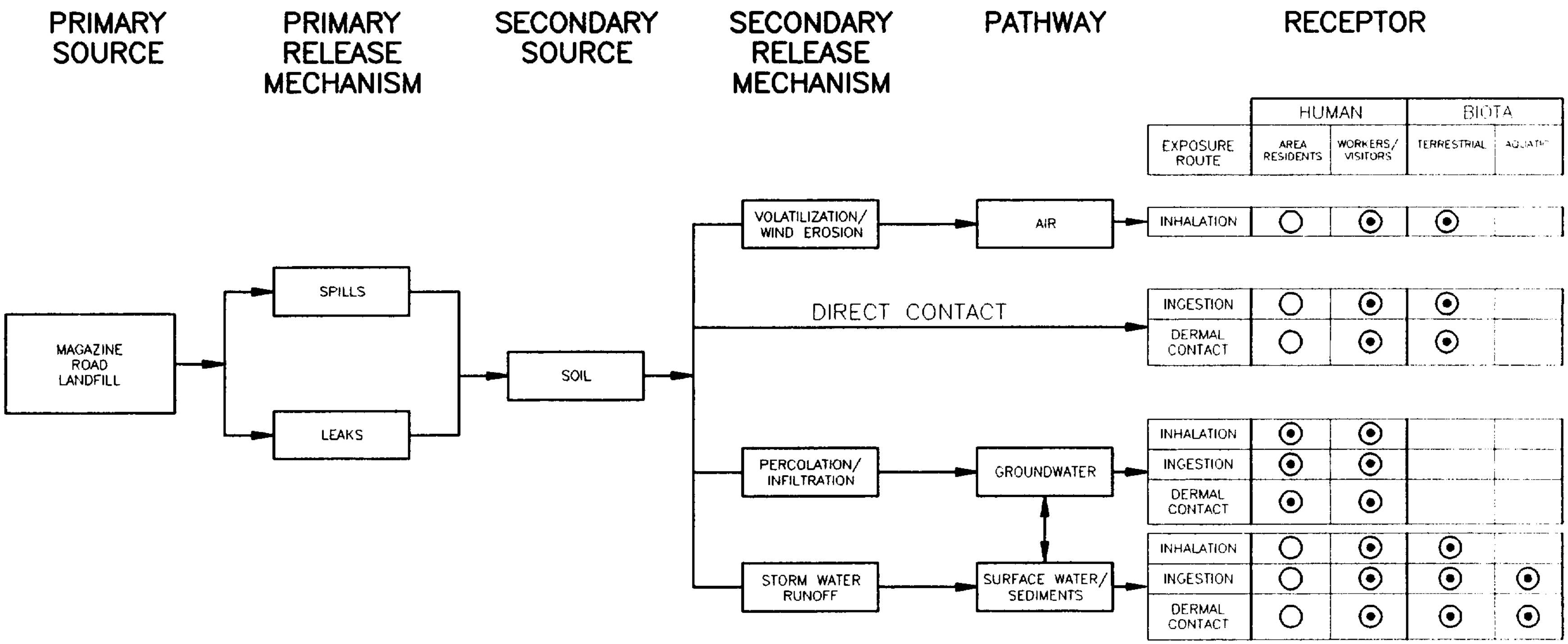


LEGEND:

● CURRENT POTENTIAL RECEPTOR

○ FUTURE POTENTIAL RECEPTOR

**Work Plan Appendix B**

**Figure B-4**

**Exposure Routes and Receptors**
**Site 2 - Magazine Road Landfill**

**MCAS El Toro, California**

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The potential pathways are air, groundwater, and surface water. Airborne contaminants are transported through fugitive dust and volatilization. The transport through air is affected by wind speed and direction, type of contaminant, and weather conditions. Typical wind condition at MCAS El Toro is from west/southwest at less than 10 knots. Transportation of airborne contaminants through volatilization is expected to be largely unimportant at this site. Surface water transport is affected by the amount of rainfall, type of contaminant, surface soil properties, and the topography of the area. The mean annual rainfall at MCAS El Toro is about 14.0 inches, most of it occurs from November through April.

Current and/or potential receptors of chemicals at this site are workers and visitors involved in disposal activities. Direct contact with surface and subsurface soils is currently possible via dermal or ingestion exposures to workers. Infiltration of contaminated water through the vadose zone into groundwater is possible because subsurface soil is mainly sands, with some silts and clays. Current off-site and potential future on- and off-site exposure of workers is possible via ingestion of groundwater at this site.

Terrestrial wildlife could be exposed to chemicals in on-site surface soil, and dust and vapors through ingestion, dermal absorption, or inhalation. Terrestrial plants could also be exposed through root absorption of chemicals in surface soil or deposition of dusts. Species occurring at this site include small mammals (California ground squirrel, southwestern pocket gopher, the desert cottontail, gophers, and kangaroo rats), foraging birds (California quail, scrub jay, and California towhee), predatory birds and mammals (owls, hawks, and foxes) other burrowing mammals. Special-status species were observed on or near the site include the California gnatcatcher, orange throated whiptail lizard, and the coastal horned lizard.

### Statement of Phase II RI Problem

Previous data indicate that the site is a source of trichloroethene (TCE) and other contaminants in groundwater. Further characterization of its extent is needed. The data also suggest that landfill gas emissions exceed allowable levels. Additional data should be collected to support closure (e.g., cap design). Sensitive habitats and species are known to occur at the site and additional data should be collected to assess potential ecological impacts.

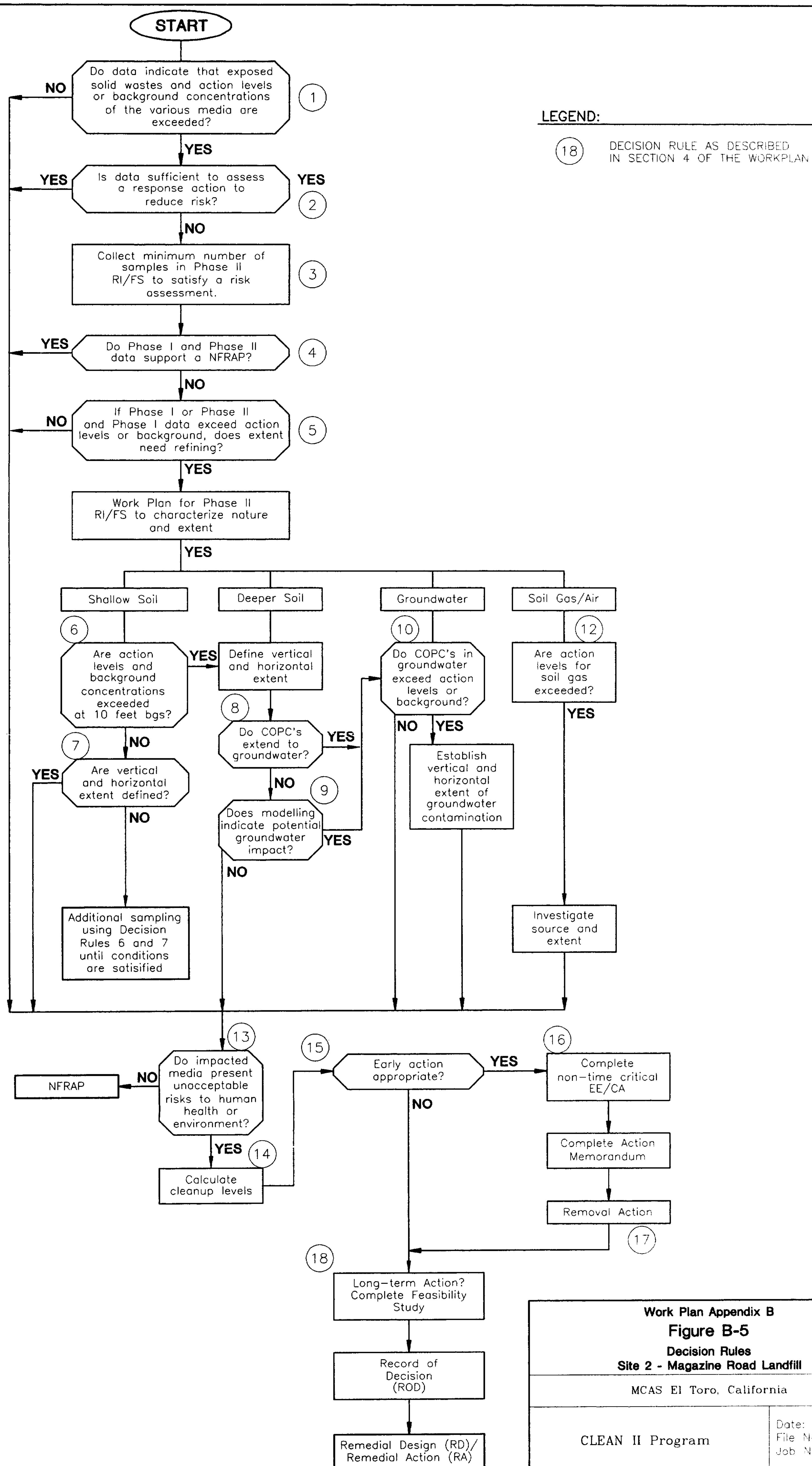
## STEP 2 – IDENTIFY THE DECISION

This step describes the decisions that will be considered during the DQO process for Site 2. For each decision, alternative outcomes that could result from the resolution of that decision are also stated. A decision logic diagram (Figure B-5) for Site 2, the Magazine Road Landfill, considers the following decisions:

1. Are solid wastes exposed?

   If yes, evaluate response actions.

   If no, evaluate other response action requirements.




**Work Plan Appendix B**

**Figure B-5**

**Decision Rules**
**Site 2 - Magazine Road Landfill**

MCAS El Toro, California

CLEAN II Program

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2. Have the limits of landfilled wastes been defined?

   If yes, recommend No Further Investigation (NFI) investigation to define limits of landfill waste.

   If no, define the limits of disposed waste using surface geophysical survey and trenching, as necessary.

3. Are the action levels for ambient air exceeded?

   If yes, evaluate response actions.

   If uncertain, collect and analyze ambient air samples.

   If no, recommend NFI for ambient air.

4. Has the landfill impacted surface water or sediment?

   If yes, assess potential contaminant sources and evaluate response actions.

   If no, recommend NFI for surface water and/or sediment.

5. Are hot spots present within the landfills?

   If yes:

   a) does evidence exist to indicate the presence and approximate location of wastes?
   b) is the hot spot known to be principal threat waste?
   c) is the waste in a discrete, accessible part of the landfill?
   d) is the hot spot known to be significant enough that its remediation will reduce the threat posed overall by the landfill, but small enough to be economically removable?

   If yes to the four proceeding questions, then evaluate treatment and removal actions.

   If no to any of the above, then recommend no further action for hot spots; however, the landfill may still require further remedial action.

6. Do data indicate that leakage from the landfill has impacted groundwater?

   If yes, characterize the nature and extent of chemicals of potential concern (COPCs) in groundwater.

   If no, recommend NFI for groundwater.

   If uncertain, install monitoring wells and collect groundwater samples at the perimeter of the landfill.

7. Do data indicate that leakage from the landfill has impacted the subsurface soil?

   If yes, vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.

   If no, recommend NFI for the subsurface soils.

If uncertain, monitor vadose zone for indications of leakage.

8. Has the nature and vertical extent of COPCs in groundwater been defined?

   If yes, recommend NFI for groundwater.

   If no, define the nature and extent of COPCs in groundwater.

9. Are ecological risks known or suspected?

   If yes, mitigate ecological risk in the remedial action.

   If no, no further evaluation of ecological risk required.

# STEP 3 – IDENTIFY THE INPUT AFFECTING THE DECISION

Step 2 defined the decisions addressing possible response actions at the site. Step 3 identifies inputs that are required to assess the possible actions.

## Inputs for No Further Action Response Action Planned

For landfill units, inputs for no further response action include performing an air emission survey of the landfill, and monitoring the vadose zone and groundwater for the presence of contaminants. Consequently, Phase II RI data collection should include verifying (where appropriate) Phase I RI air emission data through limited air emission sampling, monitoring up- and downgradient groundwater quality by installing and sampling wells, sampling subsurface soils for landfill gas, and monitoring the vadose zone beneath the landfill using gas probes installed with slant-drilling techniques.

Input information required to support a "No Further Response Action Planned" decision will also be used to support decisions for Early Action and Long-Term Action. These inputs are listed as:

- nature and concentrations of surface emitted gas (e.g., $CO_2$, $H_2S$, $CH_4$, and VOCs);
- definition of the nature and extent of COPCs in groundwater;
- nature and extent of landfill gases (e.g., $CO_2$, $H_2S$, $CH_4$, and VOCs);
- assessment of potential landfill leakage using soil gas and leachate sampling techniques;
- assessment of risk for the site; and
- action levels for protection of human health and the environment.

## Inputs for Early Action

An Early Action at a landfill may consist of a presumptive remedy. Several presumptive remedies are recognized by U.S. EPA for CERCLA municipal landfill sites (U.S. EPA 1993b). The Magazine Road Landfill can be classified as a municipal landfill because the wastes present are a large-volume, heterogeneous mixture of municipal waste (e.g., nontoxic household, construction, and landscaping debris), industrial waste, and hazardous wastes (including fuel hydrocarbons, solvents, pesticides, and metals). The presumptive remedy approach allows for unit closure after hot spot issues are settled and after taking engineered or institutional steps to limit the release of contaminants to the environment.

Under the presumptive remedy approach, engineered designs are prepared to limit the release of contaminants to the atmosphere, surface water, and groundwater. In general, the design may include:

- capping the landfill to limit direct contact with disposed waste, infiltration and resulting contaminant leaching to groundwater, and surface water runoff and erosion;
- any necessary groundwater treatment to reduce the impact of released contaminants; and
- any necessary gas control and treatment to reduce uncontrolled atmospheric releases and the mass of subsurface volatile contaminants.

Groundwater quality and landfill gas release data can also be used in streamlined risk assessment by incorporating the conceptual site model, contaminant exposure pathways, and established standards for air and water quality.

Also under the presumptive remedy, institutional controls are implemented to limit exposure to landfilled waste. The most common institutional control is a deed restriction. Related Phase II data collection activities should thus include the delineation of landfill boundaries to allow the preparation of legal descriptions for the deed restrictions.

Additional input information supporting presumptive remedy decisions include the following:

- location, nature, and extent of potential hot spots;
- existence, areal extent, depth, nature, and condition of landfill cap; and
- delineation of landfilled wastes using historic, nonintrusive (e.g., electromagnetic (EM)), or intrusive (e.g., trenching) techniques.

## Inputs for Long-Term Action

Additional input information supporting Long-Term Action decisions include the following:

- nature and extent of COPCs in subsurface soil and the characteristics of soil (e.g., gas permeability);
- typical, low, and high flow rates for surface water drainages, estimated infiltration rates, and proximity to landfilled wastes;
- aquifer characteristics; and
- topography of site.

## Descriptions of Inputs

The following subsections discuss the inputs required to assess possible response actions.

### CHEMICALS OF POTENTIAL CONCERN

COPCs for Site 2 include all chemicals detected in the Phase I RI for each media, with the exception of metals in shallow (0 to 10 feet bgs) soil and sediment (Jacobs Engineering 1993b, pages A2-4 to A2-7). Metals with concentrations in shallow soil and dry wash sediment that exceed background concentrations are defined as COPCs. COPCs for Site 2 are listed (by media and chemical class) below.

#### *Shallow Soil (0 to 10 feet below ground surface)*

- metals: mercury, silver, sodium;
- VOCs: 2-hexanone, 2-butanone, acetone, ethylbenzene, toluene, xylenes, 4-methyl-2-pentanone;
- SVOCs: benzyl butyl phthalate, bis(2-ethylhexyl) phthalate;
- herbicides: dalapon, dichloroprop, MCPP;
- pesticides and PCBs: aldrin, 4,4'-DDD, 4,4'-DDE, 4,4'-DDT; and
- fuel and petroleum hydrocarbons: TFH-gasoline, TFH-diesel.

#### *Subsurface Soil (> 10 feet below ground surface)*

- metals: 22 of 23 TAL metals;
- VOCs: acetone, toluene;
- herbicides: dalapon, 2,4-DB, MCPA; and
- SVOCs: bis(2-ethylhexyl) phthalate.

#### *Groundwater*

<u>Upgradient</u> (Well 02_UGMW25)

- general chemistry: bicarbonate, chloride, nitrate/nitrite as N, sulfate, total dissolved solids (TDS);
- metals: 12 of 23 TAL metals;
- VOCs: trichloroethene; and
- gross alpha and beta: gross alpha, gross beta.

<u>Downgradient</u> (Wells 02_DGMW59, 02_DEMW60, and 02_DGMW61)

- general chemistry: bicarbonate, chloride, nitrate/nitrite as N, sulfate, TDS;
- metals: 15 of 23 TAL metals;
- gross alpha and beta: gross alpha, gross beta; and

- VOCs: 1,2-dichloroethane, 1,2-dichloroethene, 1,1,2-trichloroethane, tetrachloroethene, chloroform, trichloroethene.

***Surface Water Runoff***

Borrego Canyon Wash

- general chemistry: bicarbonate, chloride, nitrate/nitrite as N, sulfate, TDS;
- metals: 20 of 23 TAL metals (dissolved and total metals);
- VOCs: acetone;
- fuel and petroleum hydrocarbons: TFH-diesel; and
- gross alpha and beta: gross alpha, gross beta.

***Sediment***

Borrego Canyon Wash

- metals: antimony;
- VOCs: benzene, carbon tetrachloride, methylene chloride, toluene, trichloroethene;
- SVOCs: benzyl butyl phthalate, bis(2-ethylhexyl) phthalate;
- pesticides and PCBs: alpha chlordane, gamma chlordane, 4,4'-DDT;
- herbicides: 2,4-DB; MCPP; and
- fuel and petroleum hydrocarbons: TFH-gasoline, TRPH.

## NATURE AND EXTENT OF CONTAMINATION

Phase II RI/FS sample locations and analyses have been selected so that the Phase I and II RI/FS data can be confirmed and evaluated to assess risks associated with the landfill. If further definition of extent of impacted media is necessary, then further sampling will be conducted.

## BACKGROUND CONCENTRATIONS

Background concentrations are presented in Section 4 of the Phase II RI/FS Work Plan.

## DETERMINATION OF RISK

A determination of the human health risk associated with each site is based on a baseline or streamline risk assessment. Baseline risk assessments are performed on RI/FS sites. The objective of a baseline risk assessment is to estimate the risks associated with the no action alternative and thereby provide decision makers information useful in identifying the most appropriate remedial action alternative. The risk estimates produced also serve as a benchmark to which reductions in risk achieved by remedial actions may be compared. Streamlined risk assessments are performed on removal action sites to support the removal action.

In addition to the human health risk assessment conducted for a site, an ecological risk assessment may also be performed. The ecological risk assessment will evaluate current and potential risks to the environment posed by the chemical releases that have occurred at the sites.

### IDENTIFICATION OF CLEANUP LEVELS

Cleanup levels will be based on applicable or relevant and appropriate requirements, background/ambient concentrations and risk levels to be determined for the site.

### TECHNOLOGY EFFECTIVENESS, IMPLEMENTABILITY, AND COST

Once cleanup standards have been established, the most appropriate and cost-effective approach will be identified to remediate the site/unit, if necessary.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

This step defines the spatial and temporal boundaries of the problem and any practical constraints that may interfere with the study. The boundaries of the study reflect the results of the ground-penetrating radar survey performed during the Air SWAT investigation, the EM-conductivity survey performed during the Phase I RI, and the U.S. EPA analysis of historical aerial photographs and employee interviews. The sites boundaries also encompass areas of site activity (debris, trenching, liquid, mounded material, and stains identified on historical aerial photographs) that lay outside the landfill boundaries. These activities appear to change location frequently.

The approximate boundaries of the area to be investigated in Phase II are shown in Figure B-2. In general, the boundaries include a north-south line slightly west of Magazine Road extending to a northern boundary approximately 750 feet from well 02_DGMW60, east approximately 450 feet, then south-westerly to a point approximately 50 feet southwest of well 02_DGMW60.

The site has been subdivided into study units which represent areas of generally similar geologic media or surface features. For Site 2, the study units are:

- Unit 1: area occupied by the landfill,
- Unit 2: Borrego Canyon Wash, and
- Unit 3: groundwater plume.

Phase II RI activities will be organized using the unit subdivisions listed above.

The collection of surface water samples from the Borrego Canyon Wash will be limited to times when adequate stream flow is present. If possible, samples will be collected from the first major storm event.

# STEP 5 – DEVELOP DECISION RULES

Decision rules are required to explicitly state the types of inputs and the logical basis for choosing among alternative actions during the Phase II RI/FS. The following decision rules apply to Site 2 and numbers correspond with Step 4 of the Work Plan.

3. If Phase I data are not sufficient to assess whether risks are present based on the minimum number of samples, then Tier 1 sampling of the Phase II RI/FS will be completed to supplement the Phase I analytical results. This will assure that the minimum number of samples is satisfied to assess whether action levels or background concentrations are exceeded in site units.

5. If Phase I data or Tier 1 data of the Phase II RI/FS combined with Phase I data exceed PRGs, action levels, or background/ambient concentrations for the various media, then Tier 2 of the Phase II RI/FS sampling and analyses will be conducted to define horizontal and vertical extent, provided additional sampling costs are not more than a potential response action.

6. If PRGs, action levels, or background/ambient concentrations for shallow soil are exceeded, and if COPCs detected in the soil extend to 10 feet bgs, then soil below 10 feet bgs (subsurface soil) will be investigated to assess the horizontal and vertical extent of the COPCs.

7. If during the investigation of COPCs in subsurface soil, two consecutive soil sample analyses (at minimum 5-foot separation) demonstrate that COPCs are not detected, then the vertical extent of soil contamination will be established and investigation of subsurface soil will be halted at that location. The horizontal extent will be established when COPCs are not detected in vertical samples taken at three locations around the sample that exceeds the action levels.

   The lowest detection limit available will be used to define the base of a contaminant plume. COPC detection or quantitation limits that will be compared to establish the base of the contaminant plume include the following:

   - contract-required detection limit,
   - contract-required quantitation limit,
   - sample quantitation limit,
   - estimated quantitation limit,
   - practical quantitation limit,
   - method detection limit, and
   - instrument detection limit.

9. If COPCs are identified in subsurface soil below 10 feet bgs, above background/ambient and action levels, but do not extend to the water table, then vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.

10. If it is determined that COPCs in subsurface soil have impacted groundwater causing exceedance of action levels, then the vertical and horizontal extent of groundwater exceedance will be evaluated.

12. If action levels for air are exceeded, which are specified in South Coast Air Quality Management District (SCAQMD) Rule 1150.1 (SCAQMD 1989) and 40 *Code of Federal Regulations* (CFR) Parts 258.23, then potential sources and extent will be investigated.

13. If action levels or background/ambient concentrations are exceeded for the media of a site unit, then the risk assessment will be initiated, based on sample results, acceptable levels of risk, and potential land uses, to assess potential risks to human health and/or the environment.

14. If unacceptable risks are assessed to human health or the environment, then cleanup levels will be evaluated for each media.

15. If cleanup levels in a given medium are exceeded, and if the site meets at least one of the eight criteria for removal action described in 40 CFR 300.415(b)(2), and the scale and complexity of contaminant distribution in the affected medium are such that excess risk can be expediently reduced utilizing readily available technology, then the medium at the site will be recommended for early Removal Action.

16. If a non-time-critical removal action is selected, an Engineering Evaluation/Cost Analysis and Action Memorandum will be completed for the Removal Action.

17. Once the Removal Action is completed, the site will be evaluated for residual risk. If a residual risk exists, then a Long-Term Remedial Action (RA) may be required.

18. If cleanup levels for a given medium are exceeded, and if the site does not meet criteria for an early Removal Action, then the affected medium will be recommended for Long-Term Remedial Action as part of the RI/FS process and a Feasibility Study will be completed, followed by a Record of Decision, Remedial Design, and RA to clean up the site for closure.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

Two types of sampling designs are used to determine the soil conditions at Site 2. These two sampling designs are:

- areal systematic random sampling (grid); and
- judgmental sampling.

The grid sampling design utilizes the random positioning to produce a random, unbiased sampling design, so the tolerance limits for false-positive and false-negative decision errors can be applied to the sample data obtained using these designs. Further, statistical methodology can be used to evaluate the sample analytical results against the designated action levels for this project. This provides a basis for assigning a level of confidence to the risk decisions.

The soil gas survey sampling design proposed for Site 2 is areal systematic random sampling. An areal systematic random sampling design is used to characterize the nature and extent of a problem and detect hot spots. The initial round of sampling will be on a 100-foot grid spacing, providing an 80-percent confidence of hitting a circular hot spot having a radius of 50 feet (Gilbert 1987). If, after the first round of soil gas sampling, the potential hot spots have been identified, then a second round of sampling will be performed on a 25-foot-interval grid. The 25-foot grid spacing provides an 80-percent confidence of hitting a circular hot spot with a radius of 12.5 feet (Gilbert 1987).

Judgmental sampling is designed to provide answers to more specific questions or issues; it is not performed to address general issues such as risk. As such, the confidence and power limits associated with statistically based sampling designs do not apply here. Decision errors will be considered, but they cannot be evaluated statistically. Thus, careful application of field and laboratory techniques becomes more critical because corroborating data from multiple samples will not necessarily be available. Air, groundwater, and vadose zone sample locations are judgmental. The exact sample locations will be made in the field based on available data and regulatory guidelines.

## STEP 7 – OPTIMIZE THE DESIGN

This step in the DQO process is used to identify the most resource-effective sampling and analytical design for generating data to satisfy the DQO. At Site 2, the following site units have been defined:

- Unit 1: area occupied by the landfill,
- Unit 2: Borrego Canyon Wash, and
- Unit 3: groundwater plume.

The sampling program will be implemented by following a tiered approach. At the conclusion of each tier, collected data will be evaluated; and based on the results of the evaluation, decisions will be made on whether or how to proceed with additional field activities outlined in subsequent tiers.

- Tier 1 sampling activities include collecting additional samples to assess whether the site is a risk, nonintrusive investigations, limited intrusive sampling (e.g., soil gas surveys), and the sampling of existing systems (e.g., wells).
- Tier 2 activities include more extensive and intrusive investigations to evaluate the horizontal and vertical extent of impacted media.
- Tier 3 activities include RD-oriented studies such as soil vapor extraction or aquifer tests.

Analytical tests to be performed for each media type and tier are summarized on Tables B-1 through B-5.

**Table B-1**
**Soil Sampling and Analysis – On-Site Mobile Laboratory**

| Tier | Unit/Name | No. of Locations | Samples[a]/ Location | Total Samples | ON-SITE MOBILE LABORATORY VOCs[b] | SVOCs[c] | TPH[d] | Metals | Gross Alpha & Beta[e] |
|---|---|---|---|---|---|---|---|---|---|
| Tier 1 | Landfill Area | NA[f] | | | | | | | |
| | Borrego Canyon Wash | NA | | | | | | | |
| | Groundwater Plume | TBD[g] | | | | | | | |
| Tier 2 | Landfill Area | NA | | | | | | | |
| | Borrego Canyon Wash | NA | | | | | | | |
| | Groundwater Plume | 9 | 5 | 45 | 45 | 45 | 45 | 45 | 45 |
| | *Total* | 9 | 5 | 45 | 45 | 45 | 45 | 45 | 45 |

Notes:
[a] A minimum of five samples per groundwater monitoring well will be sent to the on-site mobile laboratory.
[b] VOC – volatile organic compound
[c] SVOC – semivolatile organic compound
[d] TPH – total petroleum hydrocarbons
[e] field instrument
[f] NA – not applicable
[g] TBD – to be determined

**Table B-2**
**Soil Sampling and Analysis – Off-Site Laboratory**

| | | | | | OFF-SITE LABORATORY[a] | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tier | Unit/Name | No. of Locations | Samples[b]/ Location | Total Samples | VOCs[c] | SVOCs[d] | TPH[e] | Pesticides/ PCBs[f] | Herbicides | Total Organic Carbon[g] | Metals | Gross Alpha & Beta | Dioxin |
| Tier 1 | Landfill Area | NA[h] | | | | | | | | | | | |
| | Borrego Canyon Wash | NA | | | | | | | | | | | |
| | Groundwater Plume | TBD[i] | | | | | | | | | | | |
| Tier 2 | Landfill Area | NA | | | | | | | | | | | |
| | Borrego Canyon Wash | NA | | | | | | | | | | | |
| | Groundwater Plume | 9 | 5 | 45 | 5 | 5 | 5 | 5 | 5 | 9 | 5 | 5 | 9 |
| | *Total* | 9 | 5 | 45 | 5 | 5 | 5 | 5 | 5 | 9 | 5 | 5 | 9 |

Notes:
[a] A minimum of 20 percent of the total samples sent to the on-site mobile laboratory will be sent to an off-site laboratory for QA/QC.
[b] A minimum of five soil samples from each groundwater monitoring well will be collected for analytical testing.
[c] VOC – volatile organic compound
[d] SVOC– semivolatile organic compound
[e] TPH – total petroleum hydrocarbons
[f] PCB – polychlorinated biphenyl
[g] saturated soil sample
[h] NA – not applicable
[i] TBD – to be determined

**Table B-3**
**Soil Gas Sampling and Analysis**

| Tier | Unit/Name | No. of Locations | Samples[a]/ Location | Total Samples | ON-SITE MOBILE LABORATORY[b] TO-14 (Methane) | OFF-SITE LABORATORY[c] TO-14 (Methane) |
|---|---|---|---|---|---|---|
| Tier 1 | Landfill Area | 192[d] – TBD[e] | 1 or 3 | 208 | 208 | 21 |
| | Borrego Canyon Wash | | | | | |
| | Groundwater Plume | NA[f] | | | | |
| Tier 2 | Landfill Area | | | | | |
| | Borrego Canyon Wash | | | | | |
| | Groundwater Plume | NA | | | | |
| | *Total* | 192 | | 208 | 208 | 21 |

Notes:
[a] Samples will be collected from 184 locations on the landfill and the Borrego Canyon Wash at depths of 15 feet. Samples will be collected from 8 locations outside the landfill boundary at depths of 10, 25, and 40 feet bgs.
[b] All soil gas samples collected will be sent to the on-site mobile laboratory for analysis.
[c] A minimum of 10 percent of the samples sent to the on-site mobile laboratory will be sent to an off-site laboratory for QA/QC.
[d] Additional soil gas samples may be collected to better define hot spots within the landfill.
[e] TBD – to be determined
[f] NA – not applicable

## Table B-4
## Groundwater Sampling and Analysis

| Tier | Unit/Name | No. of Locations | Samples/ Location | Total Samples | Off-Site Laboratory | | | | | | | | On-Site Mobile Laboratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOCs[a] | SVOCs[b] | TPH[c] | Pesticides/ PCBs[d] | Herbicides | General Chemistry | Metals | Gross Alpha & Beta | VOCs |
| Tier 1 | Landfill Area | NA[e] | | | | | | | | | | | |
| | Borrego Canyon Wash | NA | | | | | | | | | | | |
| | Groundwater Plume | 4[f] | 1 | 4 | | | | | | | | | 4 |
| Tier 2 | Landfill Area | NA | | | | | | | | | | | |
| | Borrego Canyon Wash | NA | | | | | | | | | | | |
| | Groundwater Plume | 9 | 1 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 15[g] |
| | *Total* | 13 | | 13 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 9 | 19 |

Notes:
[a] VOC – volatile organic compound
[b] SVOC – semivolatile organic compound
[c] TPH – total petroleum hydrocarbons
[d] PCB – polychlorinated biphenyl
[e] NA – not applicable
[f] existing wells
[g] includes an estimated six-cone penetrometer test groundwater samples

## Table B-5
## Surface Water Sampling and Analysis

| Tier | Unit/Name | No. of Locations | Samples/ Location | Total Samples | Off-Site Laboratory | | | | | | | | On-Site Mobile Laboratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOCs[a] | SVOCs[b] | TPH[c] | Pesticides/ PCBs[d] | Herbicides | General Chemistry | Metals | Gross Alpha & Beta | VOCs |
| Tier 1 | Landfill Area | NA[e] | | | | | | | | | | | |
| | Borrego Canyon Wash | 4 | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Groundwater Plume | NA | | | | | | | | | | | |
| Tier 2 | Landfill Area | NA | | | | | | | | | | | |
| | Borrego Canyon Wash | NA | | | | | | | | | | | |
| | Groundwater Plume | NA | | | | | | | | | | | |
| | *Total* | NA | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

Notes:
[a] VOC – volatile organic compound
[b] SVOC – semivolatile organic compound
[c] TPH – total petroleum hydrocarbons
[d] PCB – polychlorinated biphenyl
[e] NA – not applicable

## UNIT 1: LANDFILL AREA – DEFINE LIMITS OF LANDFILLED WASTES

Two key components of the U.S. EPA presumptive remedy for municipal landfills include the use of a landfill cap and institutional controls (e.g., deed restrictions) to reduce surface and subsurface releases of contaminants. The purpose of Tier 1 of the Phase II RI is to help define the extent of landfilled wastes to 1) allow an estimate of the aerial size of the cap, and 2) develop legal descriptions of the landfill area for inclusion in deed restrictions.

To better define the limits of landfilled wastes, the following activities will be performed as part of Unit 1, Tier 1 tasks:

- use of existing information (e.g., geophysical data and historical aerial photographs compiled in Phase I RI) to tentatively define limits of landfilled wastes; and
- use of EM geophysical techniques to confirm or modify the tentative limits.

At the conclusion of Tier 1 activities, the following Tier 2 activities will be performed, as necessary:

- confirm EM data interpretation by performing limited trenching to expose landfilled wastes.

At Unit 1, the EM surface geophysical survey will be performed on a layout consisting of lines spaced at 50 feet; trenching will occur at locations selected after a review of results from the EM surveys (Figure B-2).

## Unit 1: Landfill Area – Evaluate Site for Hot Spots

The U.S. EPA presumptive remedy for municipal landfills included a step that addressed hot spots within landfills. Hot spots were defined as a "discrete, accessible portion of the landfill which contains principal threat wastes, such as chlorinated solvents" (U.S. EPA 1993b). Furthermore, the definition implies that the hot spot has chemical characteristics and volume such that the integrity of the presumptive remedy (i.e., containment of wastes through capping) is not threatened if the hot spot is left in place.

To evaluate the presence of hot spots within the landfill unit, the following activities will be performed as part of Unit 1, Tier 1 tasks.

- The first soil gas sampling location will be selected independently and randomly and the remaining points will be selected from a 100-foot-on-center grid from that original location. Samples will be collected from a depth of approximately 15 feet. Samples will be analyzed using an on-site mobile laboratory. Soil gas samples will be analyzed in accordance with procedures and analytical methods outlined in the Requirement for Active Soil Gas Investigations (modified to include methane) (RWQCB 1994). Laboratory test results will be used to identify potential soil gas hot spots.

- Potential hot spots (i.e., > 300 µg/L), identified by the 100-foot-grid sampling, will be further characterized using a 25-foot grid. Three hundred µg/L was selected based on the isoconcentration lines presented in the Final Soil Gas Survey (Jacobs Engineering 1994b). This value will be reevaluated after the data from the 100-foot grid survey are assessed in their entirety.

At the conclusion of Tier 1 activities, the following Tier 2 activities will be performed, as necessary. If a significant, localized source of landfilled waste gases is found, a drill rig may be used to advance a borehole(s) to investigate the nature and extent of the source. This will be accomplished through subsurface sampling and analysis of samples for VOCs, SVOCs, metals, and pesticides.

The location of soil gas grid sampling points are shown on Figure B-2.

## Unit 1: Landfill Area – Assess Air Emissions

An Air SWAT has been performed at the MCAS El Toro landfill sites to estimate landfill gas emission to the atmosphere and to assess potential health risks to human receptors. The current Air SWAT data suggest contamination during field or laboratory handling (Strata 1991, pages 3-9, 4-7, and 8-6). Consequently, more landfill gas emission data are required.

Air monitoring and sampling will be performed to reassess the migration of landfill gas into the atmosphere by verifying and supplementing existing emission data. The resulting data will be used to verify the effectiveness of the existing cap, to determine if additional control of landfill gas emission is necessary, and to support the streamlined risk assessment. Air samples will be analyzed for landfill gases and VOCs by U.S. EPA Method TO-14. Air sampling will be performed to satisfy SCAQMD Rule 1150.2 requirements for the control of gaseous emissions from inactive landfills (SCAQMD 1989). The sampling program consists of instantaneous gas sampling surveying, integrated surface gas sampling, flux chamber monitoring, ambient air sampling, landfill gas migration monitoring, and a collection of local meteorological data. Meteorological data will be used to identify the optimum number of and the optimal locations for the ambient air samples.

To assess gaseous emissions from the landfill unit, the following activities will be performed as part of Unit 1, Tier 1 tasks:

- **Instantaneous Gas Sampling** – SCAQMD Rule 1150.2 requires an instantaneous gas emissions survey as a screening process to identify the potential location of high emission concentrations where TOC emissions (measured as methane) exceed 500 $ppm_V$ at any point of the landfill surface. The instantaneous sampling survey consists of a sampling grid where the concentration of the gas immediately above the surface of the landfill is monitored with an organic vapor analyzer.

- **Integrated Surface Samples** – SCAQMD Rule 1150.2 requires integrated surface samples be collected to assure that the average concentration of TOC over a certain area (50,000 $feet^2$) does not exceed 50 $ppm_V$.

- **Flux Chamber Monitoring** – For human health and ecological risk assessment purposes, and although not required by SCAQMD Rule 1150.2, landfill gas emissions will be collected from an isolated soil surface area using an emission isolation flux chamber. The location and number of flux chamber samples will be determined after the review of the surface emission and soil gas sampling results.
- **Ambient Air Sampling** – Ambient air sampling will be performed at the perimeter of Site 2 to evaluate the potential for off-site atmospheric impacts associated with landfill gas emissions.
- **Landfill Gas Migration** – Lateral migration of landfill gas will be evaluated during the soil gas survey by collecting samples spaced at not less than 1,000 feet apart outside the fill areas and along the perimeter of the site from approximate depths of 10, 25, and 40 feet.

The general locations for Phase II RI sampling of air emissions at Site 2 correspond with areas of suspected landfilled waste, as depicted in Figure B-6. These will be refined as information is generated from geophysical surveys associated with defining landfill limits.

## Unit 1: Landfill Area – Sample Vadose Zone Below Landfill

As suggested in the previous subsection, groundwater has been impacted, possibly due to migrating leachate or liquid wastes. Vadose monitoring equipment will not be installed at Site 2 because groundwater quality data have demonstrated that contaminants have already migrated from the landfill, through the vadose zone, to groundwater.

## Unit 1: Landfill Area – Ecological Risk Assessment

Soil invertebrates, such as earthworms, will be collected from near-surface soil of the site. If earthworms are not available, a secondary matrix (small mammals such as deer mice) will be collected. Whole-body chemical analyses will be conducted for chemicals of potential ecological concern. Approximately 10 to 15 discrete sample locations on-site will be randomly selected. The results of this analyses will be compared to 10 to 15 samples collected at a reference site, which sustains a similar ecosystem located nearby. This analysis will assess the uptake of chemicals of potential ecological concern in the food chain and risk to the ecology.

## Unit 2: Borrego Canyon Wash – Evaluate Site for Hot Spots

The soil gas sampling program described for Unit 1, Tier 1 will cover Borrego Canyon Wash through Site 2 (Figure B-2). Soil gas samples will be collected to assess potential VOCs in the soil beneath the wash. Soil gas sampling beneath Borrego Canyon Wash will be used to evaluate the wash as a potential source of VOCs observed in groundwater.

To evaluate the presence of hot spots underneath the wash, the following activities will be performed as part of Unit 2, Tier 1 tasks. Soil gas samples will be collected at a depth of 15 feet. The first soil gas sample location will be selected independently and randomly and the remaining points will be selected at spacings of 100 feet from the first sampling point.

## Unit 2: Borrego Canyon Wash – Investigate Impacts to and From Surface Water

The Borrego Canyon Wash flows through portions of Site 2, draining areas both within and upstream of the site. For this site, surface hydrologic investigation entails collecting and assessing data on the wash location, the surrounding topography, the bed characteristics (e.g., roughness and permeability), the proximity to landfilled wastes, and the storm-event flow rates. Techniques used during the Phase II RI to investigate the surface hydrology of the wash include:

- the review and field-confirmation of topographic maps;
- field assessment of bed characteristics using visual observations combined with surface hydrology handbook data;
- mapping the limits of landfilled waste relative to wash location and bed limits (horizontal and vertical); and
- use of historic regional storm event data, coupled with short-term gauging of the wash, to estimate wash storm event hydrology (i.e., runoff and flow rate).

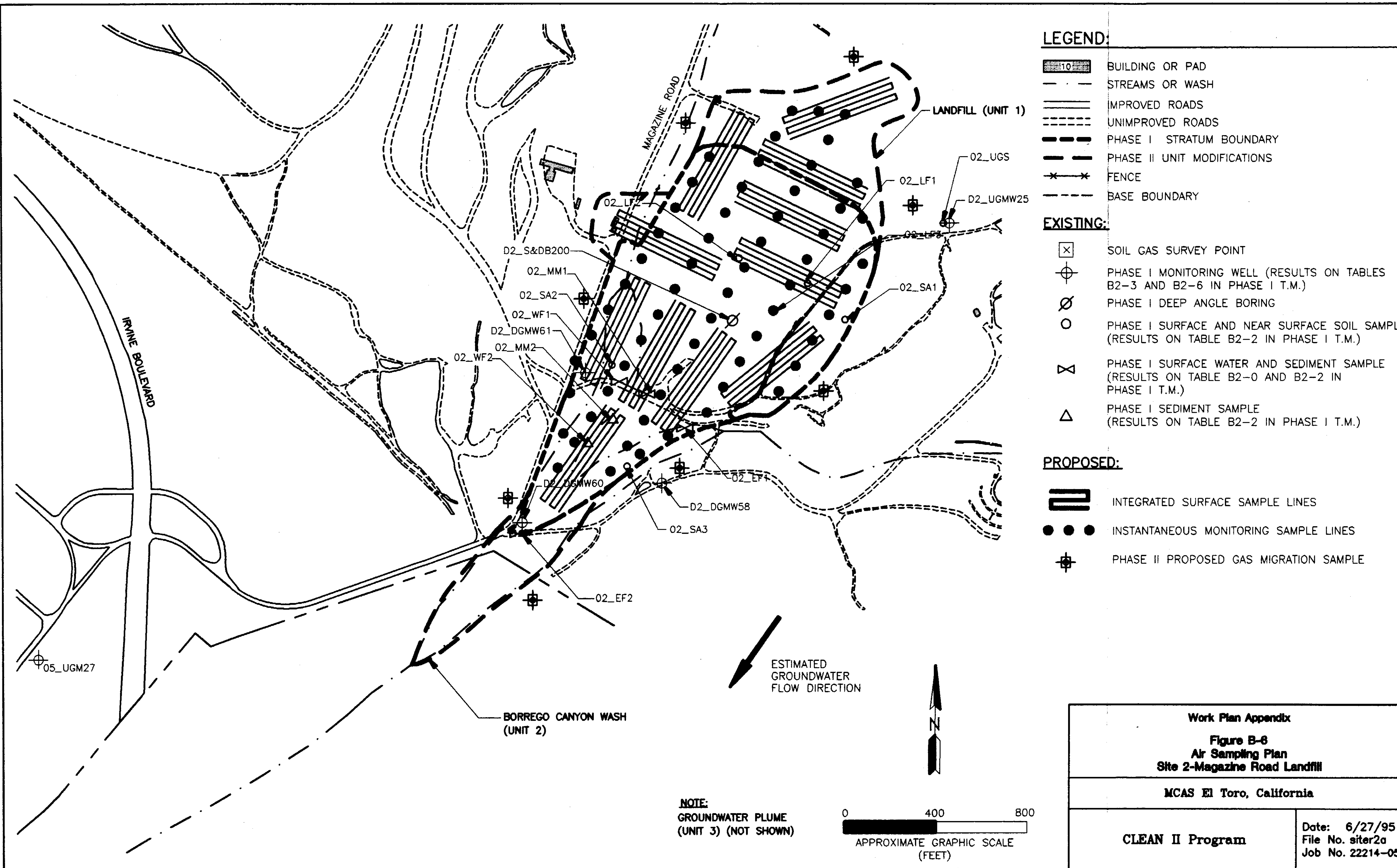
Waters within the wash have the potential to cause or accelerate the release of COPCs by:

- eroding landfill cover and exposing buried wastes;
- transporting and dispersing exposed wastes downstream from the site; and
- transporting COPCs within and through subsurface soils, possibly resulting in groundwater contamination, by surface water percolation or the creation of leachate.

To investigate the impacts of the wash, the following activities will be performed as part of Unit 2, Tier 1 tasks. Four surface water samples will be collected at the same locations as the samples and surface water samples will be collected when adequate stream flow is present.

## Unit 3: Groundwater Plume – Investigate the Extent of Groundwater Contamination

The area of study identified as Unit 3 includes the groundwater aquifer near Site 2. Landfills have the potential for impacting groundwater through leachate production and migration, liquid waste migration, and surface water percolation and transport of contaminants. This portion of the Phase II RI will assess current groundwater quality at the site and whether the landfilled wastes have impacted groundwater. If groundwater




**Work Plan Appendix**

**Figure B-6**
**Air Sampling Plan**
**Site 2-Magazine Road Landfill**

**MCAS El Toro, California**

| CLEAN II Program | Date: 6/27/95<br>File No. siter2a<br>Job No. 22214-059 |
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impacts are observed as a result of Phase II sampling, additional wells may be constructed and sampled to estimate the extent of groundwater degradation. For risk assessment purposes, the contaminant concentrations in groundwater will be compared with U.S. EPA maximum contaminant levels, as per the Safe Drinking Water Act.

In addition to answering the question of whether groundwater is impacted from landfilled wastes, data collected in this phase will also be used to conceptually design engineered remedial option(s), if impacts have occurred. The following techniques will be used to achieve these goals:

- existing wells will be sampled and analyzed for COPCs; groundwater elevations will also be measured to estimate gradient and flow direction;
- new wells will be installed where necessary to estimate groundwater gradient and flow direction at the site and to assure sampling of groundwater downgradient from landfilled wastes; these new wells will also be sampled and analyzed for COPCs; and
- the results from the above activities will be used to determine if groundwater impacts exist.

Groundwater beneath and adjacent to Site 2 contains concentrations of tetrachloroethene (PCE) and TCE that exceed federal drinking water standards. Based on a review of groundwater quality data, the contaminant plume may extend from Site 2 to an upgradient monitoring well at Site 5 (05_UGMW27). The purpose of the Unit 3 field investigations is to obtain site-specific data for the following objectives:

- to estimate the lateral and vertical extent of groundwater contamination;
- to document seasonal variations in groundwater elevations;
- to assess potential buried waste saturation due to groundwater recharge in Borrego Canyon Wash;
- to perform aquifer tests to collect hydrogeological parameters necessary for evaluating possible groundwater containment or remediation; and
- to establish a compliance groundwater monitoring network.

The horizontal extent of the VOC plume in groundwater at Site 2 is uncertain since only two episodes of groundwater monitoring have been completed. One upgradient well (02_UGMW25) and one downgradient well (02_DGMW59) that are used to characterize the horizontal extent of VOC contamination contained minor concentrations of TCE during the first sampling episode; however, no detectable concentrations of TCE were found during the second monitoring period. The two other monitoring wells at Site 2 contained TCE and PCE during both monitoring episodes. These data indicate that the horizontal characterization of the VOC plume has not been completed.

To assess the landfill impacts to groundwater and assure a compliance monitoring network, the following activities will be performed as part of Unit 1, Tier 1 tasks.

Groundwater samples will be collected from existing wells and analyzed for VOCs. Groundwater samples collected from 02_UGMW25 and 02_DGMW59 will be evaluated, and if VOCs are not detected in the groundwater samples, it will be assumed that those wells are suitable to characterize the horizontal extent of VOCs in groundwater. If VOCs are detected in wells 02_UGMW25 and 02_DGMW59, additional monitoring wells will be needed to characterize the horizontal extent of groundwater contamination.

The following activities will be performed as part of Unit 3, Tier 2 tasks.

- CPT techniques will be utilized to establish the exact locations of the groundwater monitoring wells proposed to define the horizontal extent of groundwater contamination. The CPT locations will be where the proposed wells are shown on Map B-2. Groundwater samples collected will be analyzed for VOCs in the on-site mobile laboratory.
- If VOCs are detected in the 02_UGMW25, an additional well (NEW8) will be installed to define the upgradient extent of VOC contamination. If VOCs are detected in 02_DGMW59, an additional well (NEW2) will be installed to assess the horizontal extent of VOC contamination. If no VOCs are detected in these wells, it will be assumed that the extent of VOC contamination has been delineated and additional wells are not needed.
- Install and sample one deep monitoring well (NEW1) near well 02_DGMW60 to characterize the vertical extent of VOC groundwater contamination. The new well will be drilled to approximately 150 feet bgs, which will position the well screen approximately 60 feet below the screen of well 02_DGMW60. This amount of separation has been demonstrated to be adequate for defining the vertical extent of VOC contamination in well 18_DGMW03 located in Site 24.
- Install and sample one downgradient monitoring well (NEW3) completed at the water table to assess the potential connection of VOC contamination identified in 02_DGMW60 and 05_UGMW27.
- Soil samples collected from the proposed monitoring well borings to obtain data for the estimation of equilibrium constant (Kd) and retardation factor (R). Five soil samples will be collected from two of the proposed new wells.
- If VOCs are present in the proposed deep well (NEW1), deeper wells (NEW4 and NEW5) will be drilled to assess the vertical extent of contamination. If VOCs are not detected in the deeper well, NEW4 and NEW5 will not be drilled.

The following activities will be performed as part of Unit 3, Tier 3 tasks:

- Hydrogeological data relevant to contaminant migration within the shallow aquifer will be obtained, and a pump test will be performed. The existing well 02-DGMW60 will be pumped, and piezometric levels at NEW1 will be observed.
- Soil vapor extraction pilot testing may be performed if VOC hot spots are identified within the landfill. These potential hot spots may be the source of VOC contamination observed in groundwater.

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# WORK PLAN APPENDIX C

## DATA QUALITY OBJECTIVES
## OPERABLE UNIT 2 –
## SITE 3 – ORIGINAL LANDFILL

# Summary

## STEP 1 – STATE THE PROBLEM

The problem at Site 3, Original Landfill, is to 1) determine if the landfill is the source of contamination in groundwater and 2) determine which components of the United States Environmental Protection Agency presumptive remedies (which include capping, groundwater treatment, gas control and treatment, or deed restrictions) are appropriate.

## STEP 2 – IDENTIFY THE DECISION

Decisions to be considered regarding environmental conditions at Site 3 are the following: Are solid wastes exposed? Have the limits of landfilled wastes been defined? Are the action levels for ambient air exceeded? Has the landfill impacted surface water or sediment? Have principal waste hot spots been identified within the landfill? Do data indicate that leakage from the landfill has impacted groundwater? Do data indicate that leakage from the landfill has impacted the subsurface soil? Has the nature and vertical extent of chemicals of potential concern in groundwater been defined?

## STEP 3 – IDENTIFY THE INPUTS AFFECTING THE DECISION

Inputs necessary to make the decisions listed in Step 2 include a list of chemicals of potential concern; the definition of the limits of solid waste; an assessment of potential hot spots and the nature and extent of chemicals of potential concern in groundwater; and an identification of contamination source(s) for surface water and sediment, chemicals of potential concern in the vadose zone, and landfill gas emission.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

The study is geographically limited to the Original Landfill, the portion of the Agua Chinon Wash that bisects the landfill, the Solvent Spill (solid waste management unit/area of concern 300), and the Former Incinerator (solid waste management unit/area of concern 194).

## STEP 5 – DEVELOP A DECISION RULE

Action levels developed for decision-making purposes are a cumulative excess cancer risk of $10^{-6}$ in humans and a hazard index of 1.0 for chronic systemic toxicity in humans. Based on these risk levels, decision rules are developed to protect human health and the environment in residential, industrial, and recreational land use scenarios.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The sampling designs proposed for Site 3 are areal systematic random sampling and judgmental sampling. An areal systematic random sampling design will be used to characterize the nature and extent of a problem and to detect hot spots. The initial round of sampling will be on a 200-foot grid spacing, providing an 80-percent confidence of hitting a circular hot spot having a radius of 100 feet. Judgmental sample locations will be based on previous data and regulatory guidelines.

## STEP 7 – OPTIMIZE THE DESIGN

Samples collected during the Phase II Remedial Investigation/Feasibility Study will support the remedial response for municipal landfill sites. Activities to be performed will include surface geophysics, soil gas sampling, air sampling, vadose zone sampling, and groundwater sampling.

# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| Air SWAT | Air Quality Solid Waste Assessment Test |
| AOC | area of concern |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | *Code of Federal Regulations* |
| COPC | chemical of potential concern |
| DDD | dichlorodiphenyldichloroethane |
| DDE | dichlorodiphenyldichloroethene |
| DDT | dichlorodiphenyltrichloroethane |
| DQO | data quality objective |
| EM | electromagnetic |
| FS | Feasibility Study |
| MCAS | Marine Corps Air Station |
| MCPP | 2-(2-methyl-4-chlorophenoxy)-propionic acid |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| MSL | mean sea level |
| ND | nondetect |
| NFI | No Further Investigation |
| PCB | polychlorinated biphenyl |
| pCi/L | picocuries per liter |
| $ppb_v$ | parts per billion by volume |
| $ppm_v$ | parts per million by volume |
| PRG | (U.S. EPA Region IX) Preliminary Remediation Goal |
| RCRA | Resource Conservation and Recovery Act |
| RD | Remedial Design |
| RFA | RCRA Facility Assessment |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| RWQCB | California Regional Water Quality Control Board |

# ACRONYMS/ABBREVIATIONS (continued)

| | |
|---|---|
| SAIC | Science Applications International Corporation |
| SCAQMD | South Coast Air Quality Management District |
| SVOC | semivolatile organic compound |
| SWMU | solid waste management unit |
| TAL | target analyte list |
| TFH | total fuel hydrocarbons |
| TOC | total organic compound |
| TP | trichlorophenoxyproprionic acid (Silvex) |
| TPH | total petroleum hydrocarbons |
| TRPH | total recoverable petroleum hydrocarbons |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |

## Appendix C
# SITE 3 – ORIGINAL LANDFILL

The Unites States Environmental Protection Agency (U.S. EPA) developed the data quality objective (DQO) process as a tool for project managers to determine the type, quantity, and quality of data needed to make decisions. Data produced by sampling and monitoring activities are used extensively in problem definition, rule-making, and enforcement decisions. These activities are supported through implementation of the mandatory U.S. EPA Quality System, which requires all organizations to develop and operate management processes and structures for assuring that the data collected are of the necessary and expected quality for their desired use. (U.S. EPA 1993a)

The U.S. EPA DQO process consists of the following seven steps:

1. **State the problem:** Describe the problem at the site as it is currently understood. The problem statement includes a site conceptual model and an organization and review of all relevant data.
2. **Identify the decision:** Determine an if-then statement that will define what the investigation will seek to determine and what actions will be taken based on the possible outcomes of the investigation.
3. **Identify inputs into the decision:** Specify the analytes or parameters to be measured and used.
4. **Define the study boundary:** Delineate the study boundary from information obtained from Step 1.
5. **Develop a decision rule:** Restate the decision detailing the if-then statement in specific terms.
6. **Specify acceptable limits on decision errors:** Specify how the data will be treated statistically and what the acceptable limits of uncertainty are.
7. **Optimize the design:** Design the field investigation, giving adequate consideration to the results of Steps 5 and 6. This step is described in more detail in the Field Sampling Plan .

The following sections describe the DQO process for Site 3 – Original Landfill.

## STEP 1 – STATE THE PROBLEM

Site 3 consists of the Original Landfill, a portion of the Agua Chinon Wash, the Solvent Spill (solid waste management unit[SWMU]/area of concern [AOC] 300) and the Former Incinerator (SWMU/AOC 194). Phase II Remedial Investigation (RI) investigations will focus on obtaining information needed to support evaluation of closure alternatives. Elevated levels of solvents were detected in the soil at former incinerator.

The problem at Site 3 is to 1) determine if the landfill is the source of volatile organic compounds (VOCs) in groundwater and 2) determine which components of the U.S. EPA presumptive remedies (which include capping, groundwater treatment, gas control and treatment, or deed restrictions) are appropriate.

The following sections describe the site, summarize previously collected information, present a conceptual site model, and list chemicals of potential concern.

## Site Description

Site 3, Original Landfill, comprises approximately 20 acres on Marine Corps Air Station (MCAS) El Toro, located between Perimeter Road and North Marine Way along the Agua Chinon Wash. A map illustrating the site location is included as Figure C-1. From 1943 to 1955, Site 3 was operated as a cut-and-fill landfill disposal facility in conjunction with burning to reduce waste volume. An estimated 163,500 to 243,000 cubic yards of waste material were landfilled at this site. Suspected wastes and contaminants include metals, incinerator ash, solvents, paint residues, hydraulic fluids, engine coolants, construction debris, oily wastes, municipal solid wastes, and various inert solid wastes.

Site 3 consists of at least 11 fill areas and four large stained areas. The site also includes two SWMUs/AOCs identified during the Resource Conservation and Recovery Act (RCRA) Facilities Assessment (RFA). The two SWMUs/AOCs are the Solvent Spill and Former Incinerator. The site boundaries were designated to comprise all of these areas. The site is currently being used as the RI waste staging area. West of Agua Chinon Wash, the surface consists of compacted soil and gravel. East of Agua Chinon Wash, the surface is paved with concrete. Beneath the surface is fill material of unknown thickness covering the landfill. A site plan is included as Figure C-2 and C-3.

## Previous Investigations

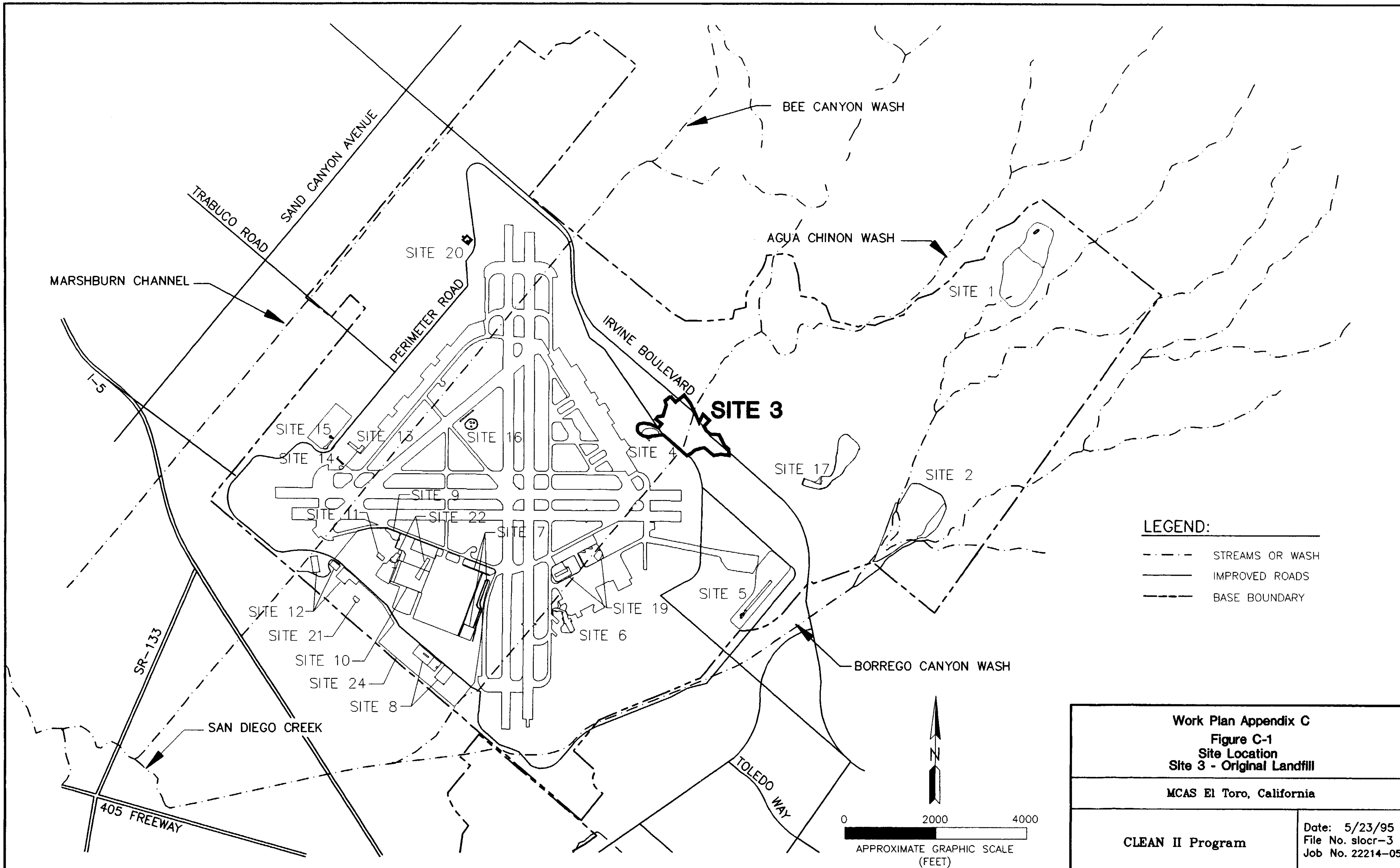
The following previous investigations are summarized below: the Phase I RI and the RFA, employee interviews, U.S. EPA aerial photographic survey, Science Applications International Corporation (SAIC) aerial photographic survey, and the Air Quality Solid Waste Assessment Test (Air SWAT). The locations of Phase I investigations are shown on Figure C-2.

### RCRA FACILITIES ASSESSMENT

An RFA was conducted by the Navy to evaluate whether an additional 140 sites at MCAS El Toro should be included under the RI/Feasibility Study (FS) program (Jacobs Engineering 1993a). Three SWMUs/AOCs were investigated, and two were recommended for further investigation. The SWMUs/AOCs are discussed below.

SWMU/AOC 194 (Former Incinerator) burned trash and municipal-type waste generated at MCAS El Toro to reduce the volume of waste prior to disposal in the adjacent Original Landfill. Currently, no visible evidence of the Former Incinerator exists. The SWMU/AOC is shown in Figure C-2. This location is only approximate and is based on the existence of former foundations. The RFA activities at SWMU/AOC 194 consisted of collecting shallow soil samples (three locations).

SWMU/AOC 300 (Solvent Spill Area) is located within the compound of the Marine Calibration Complex 3 in which electronic equipment is cleaned and calibrated.




**Work Plan Appendix C**
**Figure C-1**
**Site Location**
**Site 3 - Original Landfill**

MCAS El Toro, California

CLEAN II Program

Date: 5/23/95
File No. slocr-3
Job No. 22214-059

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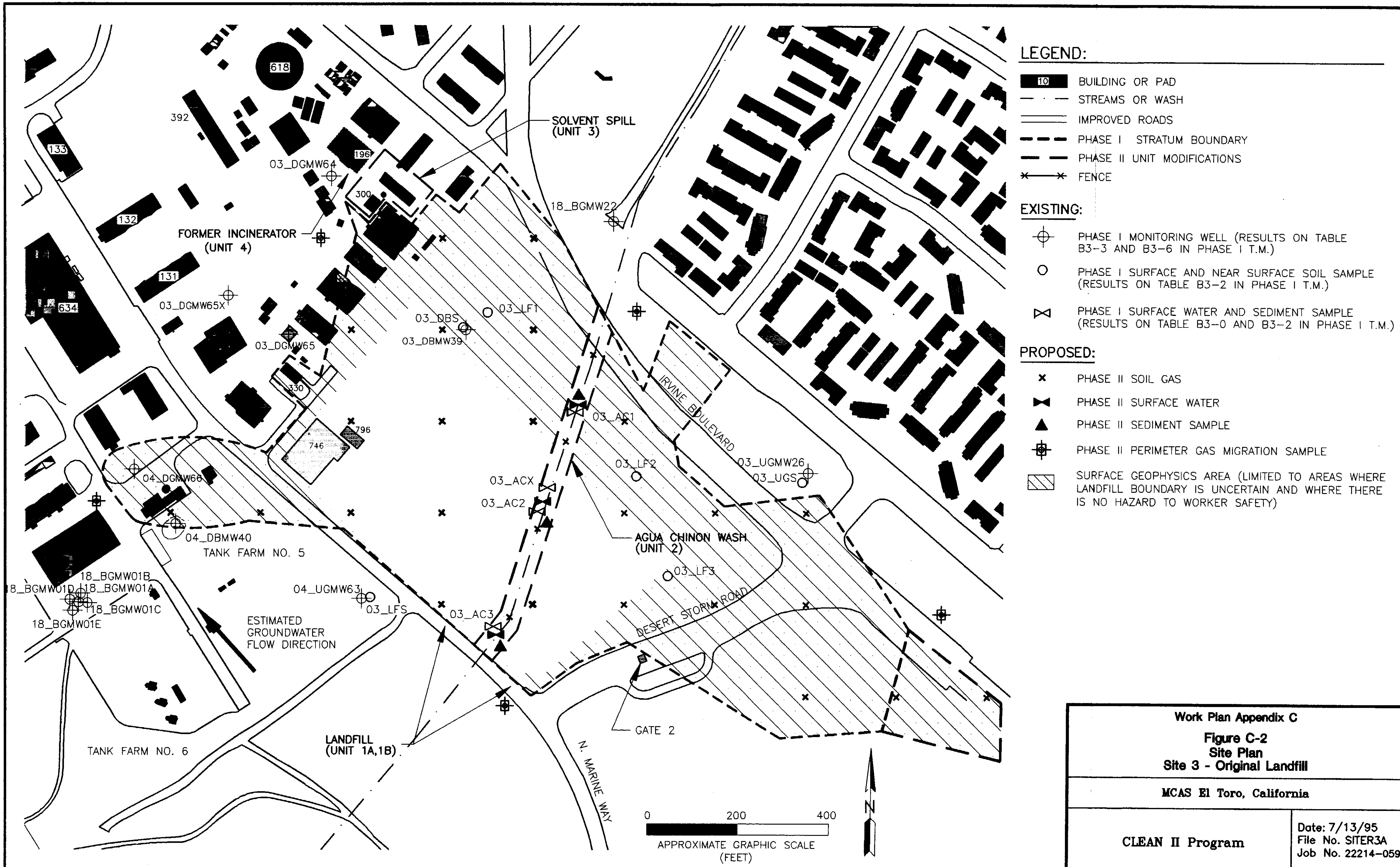


Work Plan Appendix C

**Figure C-2**
**Site Plan**
**Site 3 - Original Landfill**

MCAS El Toro, California

CLEAN II Program

Date: 7/13/95
File No. SITER3A
Job No. 22214-059

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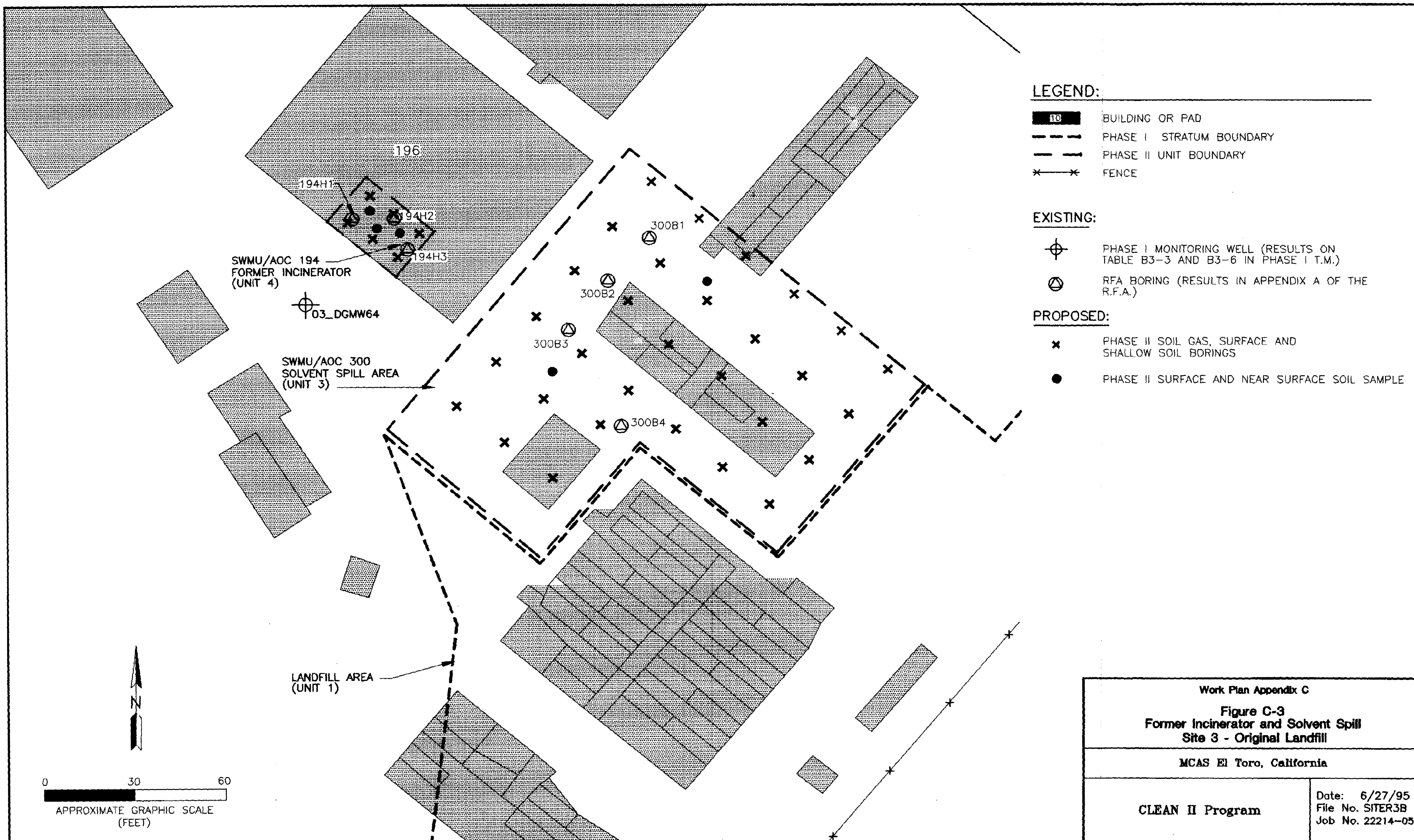


Work Plan Appendix C

**Figure C-3**
**Former Incinerator and Solvent Spill**
**Site 3 - Original Landfill**

MCAS El Toro, California

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This area consists of a large asphalt and concrete parking lot with several mobile vans. SWMU/AOC 300 is located approximately 30 feet south of SWMU/AOC 194 and approximately 70 feet northwest of the border of Site 3 (Figure C-2). The RFA activities at SWMU/AOC 300 consisted of drilling and sampling four 25-foot-deep borings.

SWMU/AOC 300 was investigated during the RFA because a strong petroleum odor was reported in October 1992 by workers digging trenches for a water supply line. In response, RFA field personnel visited the construction area to monitor for organic vapors. A portable photoionization detector measured elevated levels of organic vapors from soil stock piles removed from the trench, and the trenching activities were subsequently halted. Review of records and historical aerial photographs and interviews with personnel at MCAS El Toro indicate that the location was formerly part of the landfill, and that it may have been part of a motorpool at a later date. It was also reported that an unspecified solvent spill had occurred as a result of Marine Corps operations in this area. SWMU/AOC 300 will be included for the Phase II RI because it is covered by one of the landfill trenches.

The RFA identified abandoned Well 24-4247 as SWMU/AOC 10, but the well was not sampled because it is within the boundaries of RI/FS Site 3 (Figure C-1). This well was an oil well drilled in 1924 to a depth of 4,247 feet; it was abandoned in 1927, apparently with mud.

## PHASE I REMEDIAL INVESTIGATION

For the Phase I RI, subareas within sites were designated as strata. Due to the fact that some new subareas have been added or subareas have been expanded or added for the Phase II RI/FS, subareas within sites will be referred to as units for the Phase II RI/FS. In this section, discussion is related to Phase I RI sampling and results and the term strata will be used. Following this section, the term unit will be used.

The following activities were conducted by Jacobs Engineering at Site 3 as part of its Phase I RI (Jacobs Engineering 1993b):

- collecting surface and near-surface soil samples from five locations (three from within the site, one from the upgradient well location, and one at the location of the deep boring);
- drilling and sampling one deep boring completed as a monitoring well;
- drilling, sampling, and installing one upgradient monitoring well;
- drilling, sampling, and installing two downgradient monitoring wells;
- collecting surface water samples from Agua Chinon Wash at three locations during two storm events; and
- collecting dry wash sediment samples from Agua Chinon Wash at three locations.

A summary of analytical results for the RFA and Phase I RI is presented below (by medium and chemical class).

***Shallow Soil***

- metals: arsenic (0.51B to 4.2 milligrams per kilogram [mg/kg] [03_DBS at 0 feet]), beryllium (< 0.1 to 0.49 mg/kg [03_LF3 at 0 feet]), and 18 other target analyte list (TAL) metals;
- VOCs: toluene (2J to 9J micrograms per kilogram [µg/kg] [03_LF1 at 0 feet]);
- petroleum hydrocarbons: total recoverable petroleum hydrocarbons (TRPH) (< 14 to 202 mg/kg [03_LF1 at 0 feet]), total fuel hydrocarbons (TFH)-gasoline (< 0.05 to 13.8 mg/kg [03_LF1 at 0 feet]), TFH-diesel (< 12.4 to 13.8 mg/kg [03_LF1 at 0 feet]);
- pesticides, polychlorinated biphenyls (PCBs), herbicides; 4,4'-dichlorodiphenyltrichloroethane (DDT) (< 3.33 to 209J µg/kg [03_DBS at 0 feet]), 4,4'- dichlorodiphenyldichloroethane (DDD) (< 3.31 to 293J µg/kg [03_DBS at 0 feet]), 4,4'-dichlorodiphenyldichloroethene (DDE) (< 3.33 to 47.7J µg/kg [03_DBS at 0 feet]), 2,4,5-trichlorophenoxyproprionic acid (TP) (Silvex) (< 24.9 to 49.6 µg/kg [03_UGS at 0 feet]).

***Subsurface Soil***

- metals: arsenic (0.87B to 10.6 mg/kg [03_DGMW65 at 225 feet]), beryllium (< 0.1 to 0.76B mg/kg [03_DGMW65 at 225 feet]), and 17 other metals;
- VOCs: toluene (3J to 13J µg/kg [03_DBMW39 at 15 feet]), acetone (< 11 to 78B µg/kg [03_DGMW64 at 40 feet]), methylene chloride (< 11 to 50B µg/kg [03_UGMW26 at 85 feet]);
- petroleum hydrocarbons: TFH-gasoline (< 0.05 to 0.13 mg/kg [03_DBMW39 at 35 feet]); and
- pesticides, PCBs, herbicides: 2-(2-methyl-4-chlorophenoxy)-propionic acid (MCPP) (< 26,200 to 62,700 µg/kg [03_DBMW39 at 215 feet]), 2,4,5-TP (Silvex) (< 26.9 to 61.3J µg/kg [03_DGMW6 at 185 feet]), 2,4,5-T (< 27.2 to 41.8J µg/kg [03_DGMW65 at 225 feet]).

***Groundwater***

- metals: arsenic (2.6B to 10.7 micrograms per liter [µg/L] [03_DBMW39]), manganese (9.9B to 238 µg/L [03_DGMW 65X]), selenium (6.8 to 17.4 µg/L [03_DGMW64]), and 11 other TAL metals;
- VOCs: chloromethane (< 2 to 3 µg/L [03_DBMW39]), chloroform (< 1.0 to 0.6J µg/L [03_DBMW39]), methylene chloride (< 1.0 to 0.5J µg/L [03_DGMW65X]), xylene (< 1.0 to 0.8J µg/L [03_DGMW65X]);
- semivolatile organic compounds (SVOCs): bis(2-ethylhexyl)phthalate (< 10 to 2J µg/L [03_DGMW65X]);
- pesticides, PCBs, herbicides: dieldrin (< 0.1 to 0.11 µg/L [03_DGMW64]), heptachlor (< 0.05 to 0.07 µg/L [03_DGMW64], 4,4'-DDT (< 0.1 to 0.11 µg/L

[03_DGMW64]), lindane (< 0.1 to 0.05 µg/L [03_DGMW64]), dalapon (< 1.7 to 2.2 µg/L [03_DGMW65X]);

- radionuclides: gross alpha (8.6 to 15.9 picocuries per liter [pCi/L] [03_DBMW39]), gross beta (8.8 to 13.1 pCi/L [03_DGMW64]); and
- inorganics: nitrate/nitrite (5.73 to 15.3 mg/L [03_UGMW26]), selenium (6.8 to 17.4 mg/L [03_DGMW64]).

***Surface Water***

- metals: aluminum (dissolved 73.6B to 635 µg/L [03_AC3]); total < 73.6 to 99,000 µg/L [03_AC1]), cadmium (dissolved < 3 to 76.4 µg/L [03_AC2]; total 2.7B to 84.5 µg/L [03_AC2]), copper (dissolved 10.9B to 15.1B µg/L [03_AC2]; total 11B to 143 µg/L [03_AC1]), selenium (dissolved < 2.1 to 1.3B µg/L [03_AC3]; total < 0.5 to 24.3 µg/L [03_AC3]), zinc (dissolved 26.8 to 39.4 µg/L [03_AC2]); total 37.5 to 460 µg/L [03_AC3]), and 12 other TAL metals; and
- VOCs: acetone (< 12 to 39B µg/L [03_ACX]), 2-butanone (< 2 to 10 µg/L [03_AC2/3]), carbon disulfide (< 10 to 1 µg/L [03_AC1,2,3X]), chlorodibromomethane (< 10 to 1.5J µg/L [03_ACX]), chloromethane (1J to 3 µg/L).

***Sediment***

- metals: 17 of 23 TAL metals;
- VOCs: acetone (3J to 210B µg/kg [AC1 at 2 feet]), 2-hexanone (< 10 to 6J µg/kg [03_AC1 at 0 feet]), toluene (< 2J to 9J µg/kg [03_AC1 at 0 feet]);
- SVOCs: bis(2-ethylhexyl)phthalate (< 490J to 1,400J µg/kg [03_AC2 at 0 feet]);
- petroleum hydrocarbons: TRPH (< 14 to 223 mg/kg [03_AC2 at 0 feet]), TFH-gasoline (< 0.05 to 5.71 mg/kg [03_AC2 at 2 feet]), TFH-diesel (< 12.4 to 79.9 mg/kg [03_AC2 at 0 feet]); and
- pesticides, PCBs, herbicides: 4,4' DDT (< 3.33 to 9.64 µg/kg [03_AC3 at 2 feet]), 4,4'-DDD (3.31 to 3.83 µg/kg [03_AC3 at 0 feet]), 4,4'-DDE (< 3.33 to 4.46 µg/kg [03_AC3 at 0 feet]).

## SUMMARY OF EMPLOYEE INTERVIEWS

On 26 May 1994, a meeting was held at MCAS El Toro to interview active and retired personnel from the Station Fuel Operations Division and Facility Management Department (currently the Installations Department) who would have extensive knowledge of Station operations and procedures from storage/disposal of hazardous materials and waste (Jacobs Engineering 1994a). Participating as interviewers during the meeting were agency personnel, Navy and Station personnel, and personnel from the contractors for the Navy and the U.S. EPA. A summary of those interviews follows.

- The landfill was in operation from approximately 1943 through 1947. There were several burn pits associated with the landfill as well as an incinerator. The interview panel could not generally agree as to the exact locations of the burn pits. However, the panel concurred that many types of waste were burned at the landfill, including waste solvents, waste oils, and miscellaneous solid wastes.
- The panel did not agree as to when or where the excavation pits were located. The pits were used to burn waste that was disposed into the landfill. An incinerator was located northwest of Site 3. Most of the burning activities were conducted within the pit areas.
- The excavation that was conducted during the construction of Building 746 was probably during the early 1980s. Approximately 3,000 cubic yards of soil that revealed landfilled waste was excavated for the construction of this facility.
- The panel concurred with the boundaries of Site 3/4 shown in Figure 3-1 of the Base Realignment and Closure (BRAC) Cleanup Plan.
- Members of the panel had no knowledge of radioactive material ever being disposed of into the landfill.
- Members of the panel could not provide any information concerning Well 24-4247.

## U.S. EPA SURVEY

After a review of the U.S. EPA photograph analysis, Site 3 was defined for the Phase I RI to encompass (Jacobs Engineering 1993b):

- two excavations east of Agua Chinon Wash and possible stained areas west of the wash (identified on the 1952 photograph);
- two possible trenches west of the wash (observed on a 1963 photograph);
- numerous stains, piles of debris, and liquid stain marks west of the wash (visible on the 1970 photograph); and
- disturbed ground with possible staining west of the wash (seen on the 1980 photograph).

## SCIENCE APPLICATIONS INTERNATIONAL CORPORATION SURVEY

The Aerial Photograph Assessment performed by SAIC in 1993 revealed several features at Site 3 that had not been identified by U.S. EPA (SAIC 1993). These features, observed on the 1946 photograph, are two trenches, light- and dark-toned mounded material, stained soil, and disturbed ground. One of the two trenches was located in the northern portion of the site and was oriented northwest-southeast, overlapping the area of SWMU/AOC 300; it contained liquid in its northern part and refuse in its southern part. The other trench was oriented east-west and extended from the eastern area of the site across Perimeter Road and beyond the boundaries of Site 4. The 1958 photograph reveals a trench and several stains east and southeast of the existing site boundaries. Because the reported landfill activities ceased in 1955, the features observed on the 1958 photograph may not be related to the landfill. Aerial photographs from the 1970s show a few areas of stockpiled soil and wet soil within Site 3. In the 1978 photograph, the mounded soil appears to have been graded.

### AIR SWAT

The following activities were conducted as part of the Air SWAT (Strata 1991):

- landfill gas sampling,
- ambient air sampling,
- integrated surface sampling, and
- landfill gas migration testing.

A summary of the Air SWAT analytical results is presented below. The Air SWAT report did not quantify the analyte detection limits. If the analyte was not detected, the analyte was recorded as a nondetect (ND).

#### *Landfill gas*

- VOCs: dichloromethane (200 to 240 parts per billion by volume [$ppb_v$]) [field blank 260 $ppb_v$], chloroform (260 to 3,500 $ppb_v$), trichloroethylene (1,200 to 5,500 $ppb_v$), tetrachloroethene (ND to 27 $ppb_v$); and
- other gases: carbon dioxide (0.31 to 5.6 percent by volume).

#### *Ambient Air*

- VOCs: dichloromethane (3 to 9.1 $ppb_v$), 1,1,1-trichloroethane (ND to 5.1 $ppb_v$), tetrachloroethene (ND to 0.29 $ppb_v$)

#### *Integrated Surface Sampling*

- total organic compounds (TOCs) as methane (6.1 parts per million by volume [$ppm_v$])

#### *Landfill Gas Migration Sample Points*

- TOCs (1.7 to 2.5 $ppm_v$)

## Geology

Site 3 lies at an elevation of about 415 feet mean sea level (MSL) on the northern edge of the Tustin Plain near the foothills of the Santa Ana Mountains. A review of Phase I RI boring logs indicates that subsurface soil consists of interbedded clay, silt, sand, and gravel (Jacobs Engineering 1993b).

## Hydrogeology

Groundwater is found at a depth of approximately 240 feet below ground surface (bgs) and flows to the northwest along the regional gradient (Jacobs Engineering 1993b).

## Conceptual Site Model

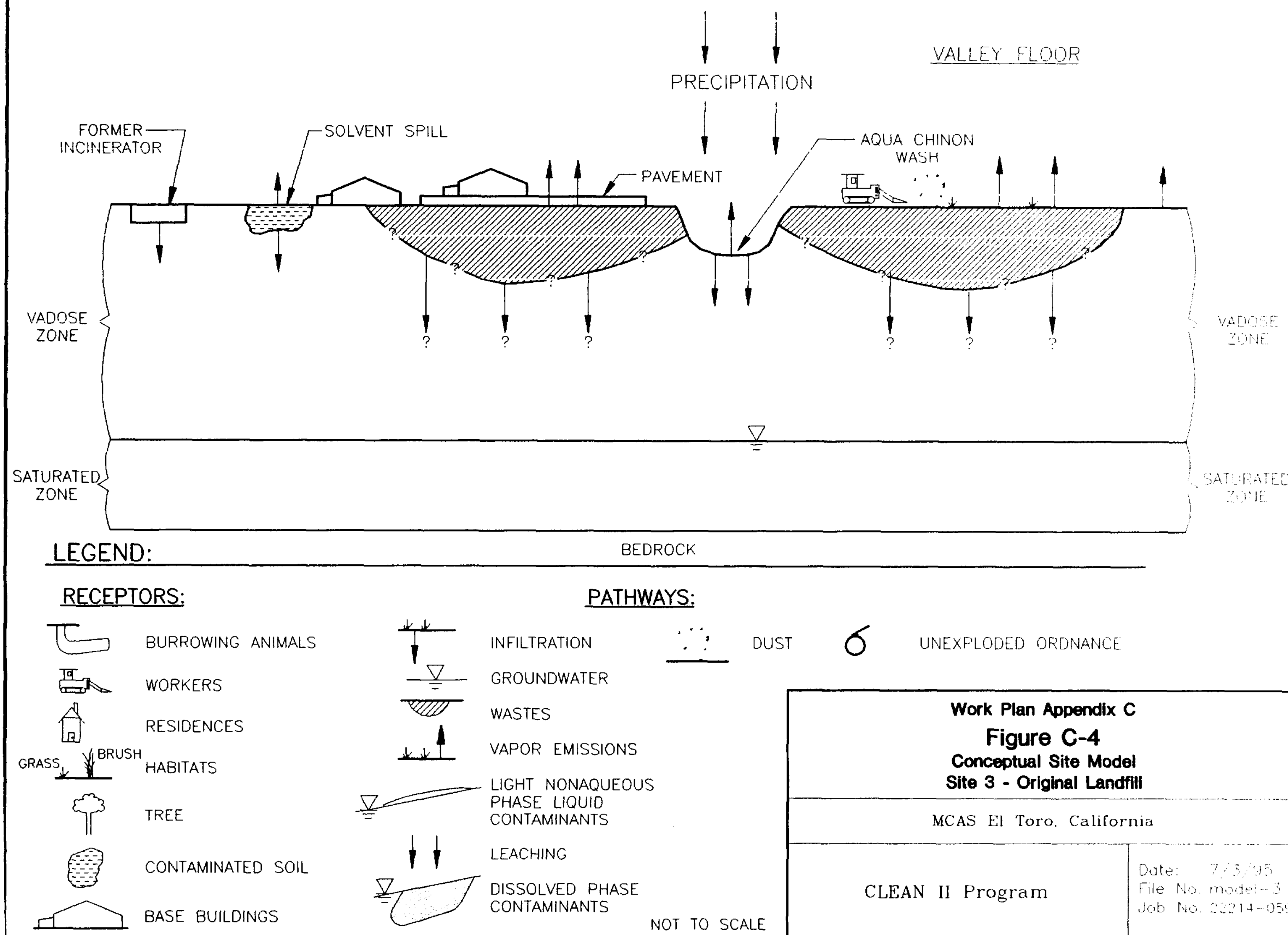
Figure C-4 shows the conceptual site model for Site 3, and Figure C-5 shows the potential exposure routes and pathways for human and ecological receptors.

The primary release mechanism is the surficial release of contaminants to shallow soil resulting from historic waste disposal activities at this site. Eventually under gravity, contaminants present in shallow soil may move downward with soil moisture (in dissolved phase) or in a liquid phase. Because this site contains a variety of wastes, the potential waste mobility in the environment could be significant. The depth of groundwater is recorded to be about 220 to 225 feet bgs.

The secondary source of contaminants is the surrounding soil impacted by disposal activities. The secondary release mechanism is the dust brought into suspension in the air. The fine particles of dust may contain all potential contaminants. Storm water runoff may form another secondary release mechanism. Storm water carries contaminants in dissolved forms, colloidal forms, or forms associated with suspended soil particles that may be carried with storm water runoff into Agua Chinon Wash or are present in surface water and sediments.

The potential pathways are air, groundwater, and surface water. Airborne contaminants are transported through fugitive dust and volatilization. The transport through air is affected by wind speed and direction, type of contaminant, and weather conditions. Typical wind condition at MCAS E1 Toro is from west/southwest at less than 10 knots. Transportation of airborne contaminants through volatilization is expected to be largely unimportant at this site. Surface water transport is affected by the amount of rainfall, type of contaminant, surface soil properties, and the topography of the area. The mean annual rainfall at MCAS El Toro is about 14.0 inches; most of it occurs from November through April.

Current and/or potential receptors of chemicals at this site are workers and visitors involved in disposal activities. Direct contact with surface and subsurface soils is currently possible via dermal or ingestion exposures to workers. Infiltration of contaminated water through the vadose zone into groundwater is possible because subsurface soil is mainly sands, with some silts and clays. However, current exposure of workers is unlikely via ingestion of groundwater at this site.




**Work Plan Appendix C**

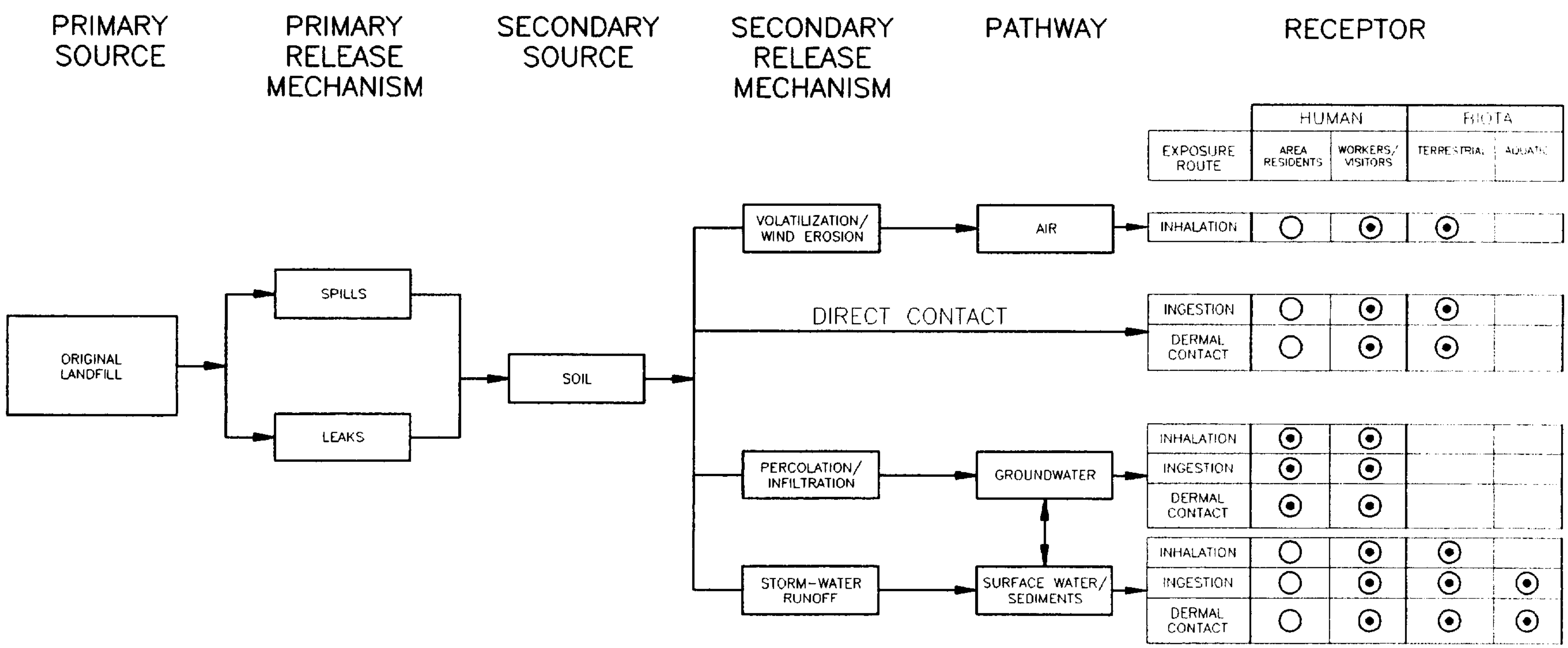
**Figure C-4**

**Conceptual Site Model**
**Site 3 - Original Landfill**

MCAS El Toro, California

CLEAN II Program

Date: 7/3/95
File No. model-3
Job No. 22214-059




## LEGEND:

- ● CURRENT POTENTIAL RECEPTOR
- ○ FUTURE POTENTIAL RECEPTOR

**Work Plan Appendix C**

**Figure C-5**

**Exposure Routes and Receptors**
**Site 3 - Original Landfill**

**MCAS El Toro, California**

CLEAN II Program

Date: 6/28/95
File No. ma13
Job No. 22214-059

Terrestrial wildlife could be exposed to chemicals in on-site surface soil and dust and vapors through ingestion, dermal absorption, or inhalation. Terrestrial plants could also be exposed through root absorption of chemicals in surface soil or deposition of dusts. Aquatic organisms, including plants, could be exposed to chemicals in surface water (through ingestion and bioaccumulation) or in sediment (through plant uptake). Species occurring at this site include mourning doves and other foraging birds, California ground squirrel, Southwestern pocket gopher, the desert cottontail, and other burrowing mammals. The site is also used by predatory birds and mammals such as foxes, hawks, and owls. No special-status species were observed at this site, and the immediate area provides marginal habitat for wildlife species.

## Statement of Phase II RI Problem

The RFA data suggest that the soil at the Solvent Spill (SWMU/AOC 300) and the Former Incinerator (SWMU/AOC 194) has been impacted. Existing data, including the Phase I RI data suggest the surface soils and gaseous emissions from landfill did not exceed U.S. EPA Region IX Preliminary Remediation Goals (PRGs) for human health. No human health criteria were exceeded in the surface water samples collected at the Agua Chinon Wash; however, ecological criteria were exceeded for aluminum, cadmium, copper, selenium, and zinc. No human health or ecological criteria were exceeded in sediment samples. Phase II RI investigations will focus on obtaining information needed to support evaluation of closure alternatives.

## STEP 2 – IDENTIFY THE DECISION

This step describes the decisions that will be considered during the DQO process for Site 3. For each decision, alternative outcomes that could result from the resolution of that decision are also stated. A decision logic diagram is included as Figure C-6. For Site 3, the Original Landfill, the following decisions are considered:

1. Are solid wastes exposed?

   If yes, evaluate response actions.

   If no, evaluate other response action requirements.

2. Have the limits of landfilled wastes been defined?

   If yes, recommend no further investigation to define limits of landfill waste.

   If no, define the limits of disposed waste using surface geophysical survey and trenching, if necessary.

3. Are the action levels for ambient air exceeded?

   If yes, evaluate response actions.

   If uncertain, collect and analyze ambient air samples.

   If no, recommend no further action for ambient air.

4. Has the landfill impacted surface water or sediment?

   If yes, assess potential contaminant sources and evaluate response actions.

   If no, recommend no further action for surface water and/or sediment.

5. Are hot spots present within the landfills?

   If yes:

   a) does evidence exist to indicate the presence of approximate location of wastes?

   b) is the hot spot known to be principal threat waste?

   c) is the waste in a discrete, accessible part of the landfill?

   d) is the hot spot known to be significant enough that its remediation will reduce the threat posed overall by the landfill, but small enough to be economically removable?

   If yes to the four proceeding questions, then evaluate treatment and removal actions.

   If no to any of the above, then recommend no further action for hot spots; however, the landfill may still require further remedial action.

6. Do data indicate that leakage from the landfill has impacted groundwater?

   If yes, characterize the nature and extent of chemicals of potential concern (COPCs) in groundwater.

   If no, recommend no further action for groundwater.

   If uncertain, install monitoring wells and collect groundwater samples at the perimeter of the landfill.

7. Do data indicate that leakage from the landfill has impacted the subsurface soil?

   If yes, vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.

   If no, recommend no further action for the subsurface soils.

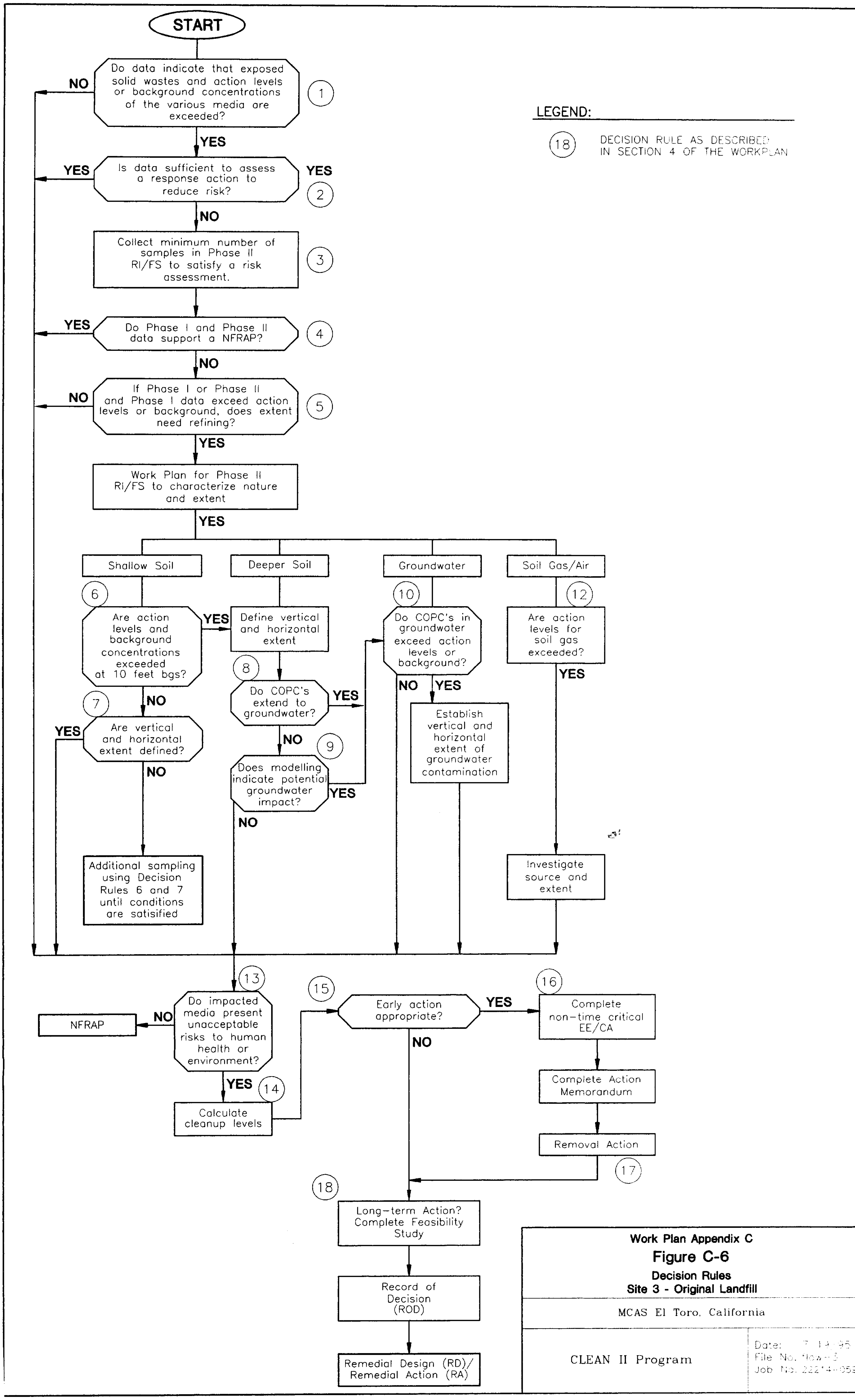
   If uncertain, monitor vadose zone for indications of leakage.

8. Has the nature and vertical extent of COPCs in groundwater been defined?

   If yes, recommend no further investigation for groundwater.

   If no, define the nature and extent of COPCs in groundwater.

9. Do COPCs in shallow soil (less than 10 feet bgs) in at the former incinerator or the solvent spill locations exceed established background concentrations, risk-based concentrations, and/or present a risk to human health or the environment?




**Work Plan Appendix C**

**Figure C-6**

**Decision Rules**

**Site 3 - Original Landfill**

MCAS El Toro, California

CLEAN II Program

Date: 7-14-95
File No. flow-3
Job No. 22214-059

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If yes, proceed to the next decision.

If no, recommend the unit for No Further Investigation (NFI).

If uncertain, collect additional data to determine.

10. Has the extent of impacted soil (former incinerator/solvent spill) been defined in the shallow soil?

    If yes, evaluate a response action.

    If no, conduct soil sampling to define extent.

11. Does the extent of impacted soil (former incinerator/solvent spill) extend to the subsurface?

    If yes, conduct soil sampling to define vertical extent on impacted soil; if necessary determine if groundwater beneath the unit is impacted.

    If no, evaluate a response action.

## STEP 3 – IDENTIFY THE INPUT AFFECTING THE DECISION

Step 1 defined the decisions addressing possible response actions at the site. Step 3 will identify inputs that are required to assess the possible actions.

## Inputs for No Further Response Action Planned

For landfill units, inputs for no further response action include performing an air emission survey of the landfill, and by monitoring the vadose zone and groundwater for the presence of possible contaminants. Consequently, Phase II RI data collection should include verification (where appropriate) of Phase I RI air emission data through limited air emission sampling, monitoring upgradient and downgradient groundwater quality by installing and sampling wells, sampling subsurface soils for landfill gas, and (where landfill gas is observed at a unit), monitoring the vadose zone beneath the landfill using gas probes installed with slant-drilling techniques.

Input information required to support a NFI decision will also be used to support decisions for Early Action and Long-Term Action. These inputs are listed below:

- nature and concentrations of surface emitted gas (e.g., $CO_2$, $H_2S$, $CH_4$, and VOCs);
- definition of the nature and extent of COPCs in groundwater;
- nature and extent of landfill gases (e.g., $CO_2$, $H_2S$, $CH_4$, and VOCs);
- assessment of potential landfill leakage using soil gas and leachate sampling techniques;
- assessment of risk for the site; and
- action levels for protection of human health and the environment.

## Inputs for Early Action

An Early Action at a landfill may consist of a presumptive remedy. Several presumptive remedies are recognized by U.S. EPA for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) municipal landfill sites (U.S. EPA 1993b). Site 3 can be classified as a municipal landfill because the wastes present are a large-volume, heterogeneous mixture of municipal waste (e.g., nontoxic household, construction, and landscaping debris) codisposed with industrial and limited hazardous wastes (including fuel hydrocarbons, solvents, pesticides, and metals). The presumptive remedy approach allows for unit closure after resolving hot spot issues and taking engineered or institutional steps to limit the release of contaminants to the environment.

Under the presumptive remedy approach, engineered step designs are prepared to limit the release of contaminants to either the atmosphere, surface water, and groundwater. In general, the steps include:

- capping the landfill to limit direct contact with disposed waste, infiltration, and resulting contaminant leaching to groundwater, and surface water runoff and erosion;
- any necessary groundwater treatment to reduce the impact of released contaminants; and
- any necessary gas control and treatment to reduce uncontrolled atmospheric releases, and the mass of subsurface volatile contaminants.

Groundwater quality and landfill gas release data can also be used in streamlined risk assessment by incorporating the conceptual site model, contaminant exposure pathways, and established standards for air and water quality.

Institutional steps under the Presumptive Remedy are designed to limit the future exposure of landfilled waste due to surface or subsurface excavations. These steps include deed restrictions. Related Phase II data collection activities should thus include the delineation of landfill boundaries to allow the preparation of legal descriptions for the deed restrictions.

Additional input information supporting Presumptive Remedy decisions include the following:

- location, nature and extent of potential hot spots;
- existence, areal extent, depth, nature, and condition of landfill cap; and
- delineation of landfilled wastes using historic, nonintrusive (e.g., electromagnetic), or intrusive (e.g., trenching) techniques.

## Inputs for Long-Term Action

Additional input information supporting Long-Term Action decisions include the following:

- nature and extent of COPCs in subsurface soil, characteristics of soil (e.g., gas permeability);
- typical, low, and high flow rates for surface water drainages; estimated infiltration rates; proximity to landfilled wastes;
- aquifer characteristics; and
- topography of site.

## Descriptions of Inputs

The following subsections discuss the inputs to assess possible response actions

### CHEMICALS OF POTENTIAL CONCERN

COPCs for Site 3 include all chemicals detected in the Phase I RI for each medium and area of investigation, with the exception of metals in shallow soil (0 to 10 feet bgs). Metals with concentrations in shallow soil that exceed background concentrations are included as COPCs and are listed (by chemical class) below.

#### *Shallow Soil*

- metals: arsenic (0.51B to 4.2 mg/kg [03_DBS at 0 feet]), beryllium (< 0.1 to 0.49 mg/kg [03_LF3 at 0 feet]), and 18 other TAL metals;
- VOCs: toluene (2J to 9J µg/kg [03_LF1 at 0 feet]);
- petroleum hydrocarbons: TRPH (< 14 to 202 mg/kg [03_LF1 at 0 feet]), TFH-gasoline (< 0.05 to 13.8 mg/kg [03_LF1 at 0 feet]), TFH-diesel (< 12.4 to 13.8 mg/kg [03_LF1 at 0 feet]);
- pesticides, PCBs, herbicides; 4,4'-DDT (< 3.33 to 47.7J µg/kg [03_DBS at 0 feet]), 4,4'- DDD (< 3.31 to 293J µg/kg [03_DBS at 0 feet]), 4,4'-DDE (< 3.33 to 209J µg/kg [03_DBS at 0 feet]), 2,4,5-TP (Silvex) (< 24.9 to 49.6 µg/kg [03_UGS at 0 feet]).

#### *Subsurface Soil*

- metals: arsenic (0.87B to 10.6 mg/kg [03_DGMW65 at 225 feet]), beryllium (< 0.1 to 0.76B mg/kg [03_DGMW65 at 225 feet]), and 17 other metals;
- VOCs: toluene (3J to 13J µg/kg [03_DBMW39 at 15 feet]), acetone (< 11 to 78B µg/kg [03_DGMW64 at 40 feet]), methylene chloride (< 11 to 50B µg/kg [03_UGMW26 at 85 feet]);
- petroleum hydrocarbons: TFH-gasoline (< 0.05 to 0.13 mg/kg [03_DBMW39 at 35 feet]); and
- pesticides, PCBs, herbicides: MCPP (< 26,200 to 62,700 µg/kg [03_DBMW39 at 215 feet]), 2,4,5-TP (Silvex) (< 26.9 to 61.3J µg/kg [03_DGMW6 at 185 feet]), 2,4,5-T (< 27.2 to 41.8J µg/kg [03_DGMW65 at 225 feet]).

### *Groundwater*

- metals: arsenic (2.6B to 10.7 µg/L [03_DBMW39]), manganese (9.9B to 238 µg/L [03_DGMW 65X]), selenium (6.8 to 17.4 µg/L [03_DGMW64]), and 11 other TAL metals;
- VOCs: chloromethane (< 2 to 3 µg/L [03_DBMW39]), chloroform (< 1.0 to 0.6J µg/L [03_DBMW39]), methylene chloride (< 1.0 to 0.5J µg/L [03_DGMW65X]), xylene (< 1.0 to 0.8J µg/L [03_DGMW65X]);
- SVOCs: bis(2-ethylhexyl)phthalate (< 10 to 2J µg/L [03_DGMW65X]);
- pesticides, PCBs, herbicides: dieldrin (< 0.1 to 0.11 µg/L [03_DGMW64]), heptachlor (< 0.05 to 0.07 µg/L [03_DGMW64], 4,4'-DDT (< 0.1 to 0.11 µg/L [03_DGMW64]), lindane (< 0.1 to 0.05 µg/L [03_DGMW64]), dalapon (< 1.7 to 2.2 µg/L [03_DGMW65X]);
- radionuclides: gross alpha (8.6 to 15.9 picocuries per liter [pCi/L] [03_DBMW39]), gross beta (8.8 to 13.1 pCi/L [03_DGMW64]); and
- inorganics: nitrate/nitrite (5.73 to 15.3 mg/L [03_UGMW26]), selenium (6.8 to 17.4 mg/L [03_DGMW64]).

### *Surface Water*

- metals: aluminum (dissolved 73.6B to 635 µg/L [03_AC3]); total < 73.6 to 99,000 µg/L [03_AC1]), cadmium (dissolved < 3 to 76.4 µg/L [03_AC2]; total 2.7B to 84.5 µg/L [03_AC2]), copper (dissolved 10.9B to 15.1B µg/L [03_AC2]; total 11B to 143 µg/L [03_AC1]), selenium (dissolved < 2.1 to 1.3B µg/L [03_AC3]; total < 0.5 to 24.3 µg/L [03_AC3]), zinc (dissolved 26.8 to 39.4 µg/L [03_AC2]); total 37.5 to 460 µg/L [03_AC3]), and 12 other TAL metals; and
- VOCs: acetone (< 12 to 39B µg/L [03_ACX]), 2-butanone (< 2 to 10 µg/L [03_AC2/3]), carbon disulfide (< 10 to 1 µg/L [03_AC1,2,3X]), chlorodibromomethane (< 10 to 1.5J µg/L [03_ACX]), chloromethane (1J to 3 µg/L).

### *Sediment*

- metals: 17 of 23 TAL metals;
- VOCs: acetone (3J to 210B µg/kg [AC1 at 2 feet]), 2-hexanone (< 10 to 6J µg/kg [03_AC1 at 0 feet]), toluene (< 2J to 9J µg/kg [03_AC1 at 0 feet]);
- SVOCs: bis(2-ethylhexyl)phthalate (< 490J to 1,400J µg/kg [03_AC2 at 0 feet]);
- petroleum hydrocarbons: TRPH (< 14 to 223 mg/kg [03_AC2 at 0 feet]), TFH-gasoline (< 0.05 to 5.71 mg/kg [03_AC2 at 2 feet]), TFH-diesel (< 12.4 to 79.9 mg/kg [03_AC2 at 0 feet]); and

- pesticides, PCBs, herbicides: 4,4' DDT (< 3.33 to 9.64 µg/kg [03_AC3 at 2 feet]), 4,4'-DDD (3.31 to 3.83 µg/kg [03_AC3 at 0 feet]), 4,4'-DDE (< 3.33 to 4.46 µg/kg [03_AC3 at 0 feet]).

### NATURE AND EXTENT OF CONTAMINATION

Phase II RI/FS sample locations and analyses have been selected so Phase I and II RI/FS data can be evaluated to determine risks associated with the landfill. If further definition of extent of impacted media is necessary, then further sampling will be conducted.

### BACKGROUND CONCENTRATIONS

Background concentrations are presented in Section 4 of the Work Plan.

### DETERMINATION OF RISK

A determination of the human health risk associated with each site is based on a baseline or streamline risk assessment. Baseline risk assessments are performed on RI/FS sites. The objective of a baseline risk assessment is to estimate the risks associated with the no action alternative and thereby provide decision makers information useful in identifying the most appropriate remedial action alternative. The risk estimates produced also serve as a benchmark to which reductions in risk achieved by remedial actions may be compared. Streamlined risk assessments are performed on removal action sites to support the removal action.

In addition to the human health risk assessment conducted for a site, an ecological risk assessment may also be performed. The ecological risk assessment will evaluate current and potential risks to the environment posed by the chemical releases that have occurred at the sites.

### IDENTIFICATION OF CLEANUP LEVELS

Cleanup levels will be based on applicable or relevant and appropriate requirements, background/ambient concentrations and risk levels that will be determined for the site.

### TECHNOLOGY EFFECTIVENESS, IMPLEMENTABILITY, AND COST

Once cleanup standards have been established, the most appropriate and cost-effective approach will be identified to remediate the site/unit, if necessary.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

This step defines the spatial and temporal boundaries of the problem and any practical constraints that may interfere with the study. The boundaries of the study reflect the results of the ground-penetrating radar survey performed during the Air SWAT investigation; the electromagnetic (EM) conductivity survey performed during the Phase I RI; U.S. EPA analysis of historical aerial photographs, and employee interviews. The sites boundaries also encompass areas of site activity (debris, trenching, liquid, mounded material, and stains identified on historical aerial photographs) that lay outside the landfill boundaries. The approximate boundaries of the area to be investigated in Phase II are shown in Figure C-2.

The site has been subdivided into study units that represent areas of generally similar geologic media or surface features. For Site 3 the study units are:

- Unit 1: area occupied by the landfill;
- Unit 2: Agua Chinon Wash;
- Unit 3: solvent spill; and
- Unit 4: former incinerator.

Phase II RI activities will be organized according to the unit subdivisions listed above.

## STEP 5 – DEVELOP DECISION RULES

Decision rules are required to state explicitly the types of inputs and the logical basis for choosing among alternative actions during the Phase II RI/FS. The following decision rules apply to Site 3, and numbers correspond with Step 4 of the Work Plan.

3. If Phase I data are not sufficient to assess whether risks are present based on the minimum number of samples, then Tier 1 sampling of the Phase II RI/FS will be completed to supplement the Phase I analytical results. Thus, the minimum number of samples will be taken to assess whether action levels or background/ambient concentrations are exceeded in site units.

5. If Phase I data or Tier 1 data of the Phase II RI/FS combined with Phase I data exceed PRGs, action levels, or background/ambient concentrations for the various media, then Tier 2 of the Phase II RI/FS sampling and analyses will be conducted to define horizontal and vertical extent, provided additional sampling costs do not exceed those for potential response action.

6. If PRGs, action levels, or background/ambient concentrations for shallow soil are exceeded, and if COPCs detected in the soil extend to 10 feet bgs, then soil below 10 feet bgs (subsurface soil) will be investigated to assess the horizontal and vertical extent of the COPCs.

7. If during the investigation of COPCs in subsurface soil, two consecutive soil sample analyses (at a minimum 5-foot-depth separation) demonstrate that COPCs are not detected, then the vertical extent of soil contamination will be established, and investigation of subsurface soil will be halted at that location. The horizontal extent will be established when COPCs are not detected in vertical samples taken at three locations around the sample that exceeds the action levels.

   The lowest detection limit available will be used to define the base of a contaminant plume. COPC detection or quantitation limits that will be compared to establish the base of the contaminant plume include the following:

- contract-required detection limit,
- contract-required quantitation limit
- sample quantitation limit,
- estimated quantitation limit,
- practical quantitation limit,
- method detection limit, and
- instrument detection limit.

9. If COPCs are identified in subsurface soil below 10 feet bgs, above background/ambient and action levels, but do not extend to the water table, then vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.
10. If it is determined that COPCs in subsurface soil have impacted groundwater causing exceedance of action levels, then the vertical and horizontal extent of groundwater exceedance will be evaluated.
11. If action levels or background/ambient concentrations for surface water or sediment are exceeded, then potential sources (these will likely be nonpoint sources) will be investigated.
12. If action levels for air are exceeded, which are specified in South Coast Air Quality Management District (SCAQMD) Rule 1150.1 and 40 *Code of Federal Regulations* (CFR) Parts 258.23, then potential sources and extent will be investigated.
13. If action levels or background/ambient concentrations are exceeded for the media of a site unit, then the risk assessment will be initiated, based on sample results, acceptable levels of risk, and potential land uses, to assess potential risks to human health and/or the environment.
14. If unacceptable risks are assessed to human health or the environment, then cleanup levels will be evaluated for each media.
15. If cleanup levels in a given medium are exceeded, and if the site meets at least one of the eight criteria for removal action described in 40 CFR 300.415(b)(2), and the scale and complexity of contaminant distribution in the affected medium are such that excess risk can be expediently reduced using readily available technology, then the medium at the site will be recommended for Early Action.
16. If a Non-Time-Critical Removal Action is selected, an Engineering Evaluation/Cost Analysis and Action Memorandum will be completed for the removal action.
17. Once the removal action is completed, the site will be evaluated for residual risk. If a residual risk exists, then a Long-Term Action may be required.
18. If cleanup levels for a given medium are exceeded, and if the site does not meet criteria for an Early Action, then the affected medium will be recommended for long-

term remedial action as part of the RI/FS process; and an FS will be completed, followed by a Record of Decision, Remedial Design (RD), and Remedial Action to clean up the site for closure.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

Three types of sampling designs are used to determine the soil conditions at Site 3. These sampling designs are:

- areal systematic random sampling (grid);
- systematic random sampling on a linear axis; and
- judgmental sampling.

The grid sampling design uses the random positioning to produce a random, unbiased sampling design. The tolerance limits for false-positive and false-negative decision errors can be applied to the sample data obtained using these designs. Further, statistical methodology can be used to evaluate the sample analytical results against the designated action levels for this project. This provides a basis for assigning a level of confidence to the risk decisions.

The soil gas survey sampling design proposed for Site 3 is areal systematic random sampling. An areal systematic random sampling design is used to characterize the nature and extent of a problem and to detect hot spots. The initial round of sampling will be on a 200-foot grid spacing, providing a 80-percent confidence of hitting a circular hot spot having a radius of 100 feet (Gilbert 1987). If after the first round of soil gas sampling, and potential hot spots have been identified, then a second round of sampling will be performed on a 25-foot interval grid. The 25-foot grid spacing provides a 80-percent confidence of hitting a circular hot spot with a radius of 12.5 feet. Soil gas samples collected from Unit 3 (solvent spill) and Unit 4 (former incinerator) will be on a 20-feet and 10-feet interval grid, respectively. Twenty- and 10-foot grid spacings provide an 80-percent confidence of hitting a circular hot spot with a radius of 10 and 5 feet, respectively (Gilbert 1987).

Systematic random sampling is sampling along a linear axis. Its methodology is similar to the grid sample design described, in that it uses the random positioning to produce an unbiased sample location configuration. The specifics of the sampling design is presented in Section 4 of the Work Plan. The soil gas samples locations to be collected in the Unit 2–Agua Chinon Wash was based on systematic random sampling along a linear axis.

Judgmental sampling is a special design that is not performed to address general issues such as risk. Rather, judgmental sampling is designed to provide answers to more specific questions or issues. As such, the confidence and power limits associated with statistically based sampling designs do not apply here. Decision errors will be considered, but they cannot be evaluated statistically. This makes careful application of field and laboratory techniques important because corroborating data from multiple samples will not necessarily be available. Air, soil, sediment, groundwater, and vadose zone sample locations are judgmental. The exact sample locations will be made in the field based on available data and regulatory guidelines.

## STEP 7 – OPTIMIZE THE DESIGN

This step in the DQO process is used to identify the most resource-effective sampling and analytical design for generating data to satisfy the DQO.

As discussed in Step 4, the following site units have been defined:

- Unit 1: area occupied by the landfill;
- Unit 2: Agua Chinon Wash;
- Unit 3: solvent spill; and
- Unit 4: former incinerator.

The sampling program will be implemented by following a tiered approach. At the conclusion of each tier, collected data will be evaluated, and based on the results of the evaluation, decisions will be made whether or how to proceed with additional field activities outlined in subsequent tiers. Analytical tests to be performed for each media type and tier are summarized on Tables C-1 through C-7. The sampling program for each tier is described below.

- Tier 1 activities includes collecting additional samples to assess whether the site is a risk, nonintrusive investigations, limited intrusive sampling (e.g., soil gas surveys), and the sampling of existing systems (e.g., wells).
- Tier 2 activities include more extensive intrusive investigations to evaluate the horizontal and vertical extent of impacted media.
- Tier 3 activities include RD-oriented studies, such as soil vapor extraction, or aquifer tests.

## Unit 1: Landfill Area – Define Limits of Landfilled Wastes

Two key components of the U.S. EPA Presumptive Remedy for municipal landfills include the use of a landfill cap and institutional controls (e.g., deed restrictions) to reduce surface and subsurface releases of contaminants (U.S. EPA 1993b). The purpose of Tier 1 of the Phase II RI is to help define the extent of landfilled wastes: 1) to allow an estimate of the areal size of the cap, and 2) to develop legal descriptions of the landfill area for inclusion in deed restrictions.

To better define the limits of landfilled wastes and locate abandoned Well 24_4247, the following activities will be performed as part of Unit 1, the Tier 1 tasks:

- use of existing information (e.g., geophysics data and historical aerial photographs compiled in Phase I RI) to tentatively define limits of landfilled wastes and locate abandoned Well 24_4247; and

## Table C-1
## Soil Sampling and Analysis – On-Site Mobile Laboratory

| Tier | Unit/Name | No. of Locations | Samples/ Location[a] | Total Samples | ON-SITE MOBILE LABORATORY | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOCs[b] | SVOCs[c] | TPH[d] | Pesticides/ PCBs[e] | Metals | Gross Alpha & Beta[f] |
| Tier 1 | Landfill Area | 3 | | | | | | | | |
| | Agua Chinon Wash | NA[g] | | | | | | | | |
| | Solvent Spill | 2 | 3 | 6 | 6 | 6 | 6 | 6 | 6 | |
| | Former Incinerator | 3 | 3 | 9 | 9 | 9 | 9 | 9 | 9 | |
| Tier 2 | Landfill Area | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Agua Chinon Wash | NA | | | | | | | | |
| | Solvent Spill | TBD[ih] | | | | | | | | |
| | Former Incinerator | TBD | | | | | | | | |
| *Total* | | | | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

Notes:
[a] A minimum of one soil sample from each slant boring drilled in the vadose zone will be sent to the on-site mobile laboratory. Additional samples will be collected if it is determined additional wells are necessary.
[b] VOC – volatile organic compound
[c] SVOC – semivolatile organic compound
[d] TPH – total petroleum hydrocarbons
[e] PCB – polychlorinated biphenyl
[f] field instrument
[g] NA – not applicable
[h] TBD – to be determined

## Table C-2
## Soil Sampling and Analysis – Off-Site Laboratory

| | | | | | OFF-SITE LABORATORY[a] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tier** | **Unit/Name** | **No. of Locations** | **Samples/ Location[b]** | **Total Samples** | **VOCs[c]** | **SVOCs[d]** | **TPH[e]** | **Pesticides/ PCBs[f]** | **Herbicides** | **Metals** | **Gross Alpha & Beta** |
| Tier 1 | Landfill Area | 3 | | | | | | | | | |
| | Agua Chinon Wash | NA[g] | | | | | | | | | |
| | Solvent Spill | 2 | 3 | 6 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| | Former Incinerator | 3 | 3 | 9 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| Tier 2 | Landfill Area | 2 | 1 | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Agua Chinon Wash | NA | | | | | | | | | |
| | Solvent Spill | TBD[h] | | | | | | | | | |
| | Former Incinerator | TBD | | | | | | | | | |
| *Totals* | | | | 17 | 3 | 3 | 3 | 3 | 3 | 3 | 2 |

Notes:
[a] A minimum of 10 percent of the total samples sent to the on-site mobile laboratory (per unit) will be sent to an off-site laboratory for quality assurance/quality control.
[b] A minimum of one soil sample from each slant boring drilled in the vadose zone will be collected for analytical testing.
[c] VOC – volatile organic compound
[d] SVOC – semivolatile organic compound
[e] TPH – total petroleum hydrocarbons
[f] PCB – polychlorinated biphenyl
[g] NA – not applicable
[h] TBD – to be determined

## Table C-3
## Soil Gas Sampling and Analysis

| Tier | Unit/Name | No. of Locations | Samples/ Location[a] | Total Samples | ON-SITE MOBILE LABORATORY[b] | OFF-SITE LABORATORY[c] |
|---|---|---|---|---|---|---|
| | | | | | TO-14 (Methane) | TO-14 (Methane) |
| Tier 1 | Landfill Area | 29[d]+TBD[e] | 1 or 3 | 39 | 39 | 4 |
| | Agua Chinon Wash | 4 | 1 | 4 | 4 | 0 |
| | Solvent Spill | 30 | 1 | 30 | 30 | 3 |
| | Former Incinerator | 6 | 1 | 6 | 6 | 1 |
| Tier 2 | Landfill Area | 2 | 1 | 2 | 2 | 1 |
| | Agua Chinon Wash | | | | | |
| | Solvent Spill | | | | | |
| | Former Incinerator | | | | | |
| | Total | 71 | | 81 | 9 | |

Notes:

[a] Samples will be collected from 24 locations on the landfill at depths of 15 feet. Samples will be collected from 5 locations outside the landfill boundary at depths of 10, 25, and 40 feet bgs; a minimum of one sample will be collected from each slant boring drilled in the vadose zone.

[b] all soil gas samples collected will be sent to the on-site mobile laboratory for analysis

[c] a minimum of 20 percent of the samples sent to the on-site mobile laboratory will be sent to an off-site laboratory for QA/QC

[d] additional soil gas samples may be collected to better define hot spots within the landfill

[e] TBD – to be determined

## Table C-4
## Groundwater Sampling and Analysis

| | | | | | Off-site Laboratory | | | | | | | | On-site Mobile Laboratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tier | Unit/Name | No. of Locations | Samples/ Location | Total Samples | VOCs[a] | SVOCs[b] | TPH[c] | Pesticides/ PCBs[d] | Herbicides | General Chemistry | Metals | Gross Alpha & Beta | VOCs |
| Tier 1 | Landfill Area | 4[e] | 1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | Agua Chinon Wash | NA[f] | | | | | | | | | | | |
| | Solvent Spill | NA | | | | | | | | | | | |
| | Former Incinerator | NA | | | | | | | | | | | |
| Tier 2 | Landfill Area | TBD[g] | | | | | | | | | | | |
| | Agua Chinon Wash | NA | | | | | | | | | | | |
| | Solvent Spill | NA | | | | | | | | | | | |
| | Former Incinerator | NA | | | | | | | | | | | |
| | *Total* | 4 | | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

Notes:
- [a] VOC – volatile organic compound
- [b] SVOC – semivolatile organic compound
- [c] TPH – total petroleum hydrocarbons
- [d] PCB – polychlorinated biphenyl
- [e] samples from existing wells
- [f] N/A – not applicable
- [g] TBD – to be determined

## Table C-5
## Sediment Sampling and Analysis – On-Site Mobile Laboratory

| Tier | Unit/Name | No. of Locations | Samples/ Location | Total Samples | ON-SITE MOBILE LABORATORY | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOCs[a] | SVOCs[b] | TPH[c] | Metals | Gross Alpha & Beta |
| Tier 1 | Landfill Area | NA[d] | | | | | | | |
| | Agua Chinon Wash | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Solvent Spill | NA | | | | | | | |
| | Former Incinerator | NA | | | | | | | |
| Tier 2 | Landfill Area | NA | | | | | | | |
| | Agua Chinon Wash | TBD[e] | | | | | | | |
| | Solvent Spill | NA | | | | | | | |
| | Former Incinerator | NA | | | | | | | |
| | *Total* | 3 | | 3 | 3 | 3 | 3 | 3 | 3 |

Notes:
[a] VOC – volatile organic compound
[b] SVOC – semivolatile organic compound
[c] TPH – total petroleum hydrocarbons
[d] N/A – not applicable
[e] TBD – to be determined

**Table C-6**
**Sediment Sampling and Analysis – Off-Site Laboratory**

| Tier | Unit/Name | No. of Locations | Samples/ Location | Total Samples | OFF-SITE LABORATORY[a] | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | VOCs[b] | SVOCs[c] | TPH[d] | Pesticides/ PCBs[e] | Herbicides | Metals | Gross Alpha & Beta |
| Tier 1 | Landfill Area | NA[f] | | | | | | | | | |
| | Agua Chinon Wash | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Solvent Spill | NA | | | | | | | | | |
| | Former Incinerator | NA | | | | | | | | | |
| *Subtotals* | | | | 3 | 1 | 1 | 1 | 1 | | 1 | 1 |
| Tier 2 | Landfill Area | NA | | | | | | | | | |
| | Agua Chinon Wash | TBD[g] | | | | | | | | | |
| | Solvent Spill | NA | | | | | | | | | |
| | Former Incinerator | NA | | | | | | | | | |
| *Total* | | 3 | | 3 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Notes:
[a] a minimum of 10 percent of the total samples sent to the on-site mobile laboratory will be sent to an off-site laboratory for quality assurance/quality control
[b] VOC – volatile organic compound
[c] SVOC – semivolatile organic compound
[d] TPH – total petroleum hydrocarbons
[e] PCB – polychlorinated biphenyl
[f] NA – not applicable
[g] TBD – to be determined

## Table C-7
## Surface Water Sampling and Analysis

| Tier | Unit/Name | No. of Locations | Samples/ Location | Total Samples | Off-site Laboratory: VOCs[a] | Off-site Laboratory: SVOCs[b] | Off-site Laboratory: TPH[c] | Off-site Laboratory: Pesticides/ PCBs[d] | Off-site Laboratory: Herbicides | Off-site Laboratory: General Chemistry | Off-site Laboratory: Metals | Off-site Laboratory: Gross Alpha & Beta | Onsite Mobile Laboratory: VOCs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tier 1 | Landfill Area | NA[e] | | | | | | | | | | | |
| | Agua Chinon Wash | 3 | 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| | Solvent Spill | NA | | | | | | | | | | | |
| | Former Incinerator | NA | | | | | | | | | | | |
| Tier 2 | Landfill Area | NA | | | | | | | | | | | |
| | Agua Chinon Wash | TBD[f] | | | | | | | | | | | |
| | Solvent Spill | NA | | | | | | | | | | | |
| | Former Incinerator | NA | | | | | | | | | | | |
| | *Total* | 3 | | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Notes:
[a] VOC – volatile organic compound
[b] SVOC – semivolatile organic compound
[c] TPH – total petroleum hydrocarbons
[d] PCB – polychlorinated biphenyl
[e] NA – not applicable
[f] TBD – to be determined

- confirmation or modification of the tentative limits and location of abandoned Well 24_4247 with the use of EM geophysical techniques.

At the conclusion of Tier 1 activities the following Tier 2 activities will be performed, as necessary: confirmation of the EM data interpretation by performing limited trenching to expose landfilled wastes.

At Unit 1, the EM surface geophysical survey will be performed on a layout consisting of lines spaced at 50 feet; trenching will occur at locations selected after a review of results from the EM surveys (Figure C-2).

## Unit 1: Landfill Area – Evaluate Site for Hot Spots

The U.S. EPA Presumptive Remedy for municipal landfills includes a step that addresses hot spots within landfills. Hot spots are defined by the U.S. EPA as a "discrete, accessible portion of the landfill which contains principal threat wastes, such as chlorinated solvents." The definition implies that the hot spot has chemical characteristics and volume such that the integrity of the Presumptive Remedy (i.e., containment of wastes through capping) is not threatened if the hot spot is left in place (U.S. EPA 1993b).

To evaluate the presence of hot spots within the landfill, the following activities will be performed as part of Unit 1, the Tier 1 tasks.

- The first soil gas sampling location will be selected independently and randomly. The remaining points will be selected from a 200-foot on-center grid from that original location. Samples will be collected from a depth of approximately 15 feet. Samples will be analyzed using an on-site mobile laboratory. Soil gas samples will be analyzed in accordance with procedures and analytical methods outlined in the California Regional Water Quality Control Board (RWQCB) "Requirement for Active Soil Gas Investigations" (modified to include methane). Laboratory test results will be used to identify potential soil gas hot spots (RWQCB 1994).
- Potential hot spots (i.e., > 300 µg/L), identified by the 200-foot grid for sampling, will be further characterized using a 25-foot grid. A value of 300 µg/L was selected based on the isoconcentration lines presented in the Final Soil Gas Survey (Jacobs Engineering 1994b). This value will be reevaluated after the data from the 200-foot grid survey are assessed in their entirety.

At the conclusion of Tier 1 activities, the following Tier 2 activities will be performed as necessary.

- If a significant, localized source of landfilled waste gases is found, a drill rig will be used to advance a borehole(s) to further investigate the nature and extent of the source. This will be accomplished through subsurface sampling and analysis of samples for VOCs, SVOCs, metals, and pesticides.

The location of soil gas grid sampling points are shown on Figure C-2.

## Unit 1: Landfill Area – Assess Air Emissions

Air SWATs have been performed at the MCAS El Toro landfill sites to estimate emissions to the atmosphere and to assess potential health risks to human receptors of these emissions. The current Air SWAT data are questionable, because they suggest contamination during field or laboratory handling (Strata 1991). Consequently, more air emissions data are required.

Air monitoring and sampling will be performed to reassess the migration of landfill gas into the atmosphere by verifying and supplementing existing emission data. The resulting data will be used to verify the effectiveness of the existing cap; determine if additional control of landfill gas emission is necessary; and support the streamlined risk assessment. Air samples will be analyzed for landfill gases and VOCs by U.S. EPA Method TO-14. Air sampling will be performed to satisfy SCAQMD Rule 1150.2 requirements for the control of gaseous emissions from inactive landfills (SCAQMD 1989). The sampling program consists of instantaneous gas sampling surveying, integrated surface gas sampling, flux chamber monitoring, ambient air sampling, landfill gas migration, monitoring, and collection of local meteorological data. Meteorological data will be used to identify the optimum number and locations of the ambient air samples.

To assess gaseous emissions from the landfill unit, the following activities will be performed as part of Unit 1, Tier 1 tasks.

- Instantaneous Gas Sampling – SCAQMD Rule 1150.2 requires an instantaneous gas emissions survey as a screening process to identify potential location of high emission concentrations, where TOC emissions, measured as methane, exceeds 500 $ppm_v$ at any point of the landfill surface. The instantaneous sampling survey consists of a sampling grid where the concentration of the gas immediately above the surface of the landfill is monitored with an organic vapor analyzer.

- Integrated Surface Samples – SCAQMD Rule 1150.2 requires integrated surface samples be collected to assure that the average concentration of TOCs over a certain area (50,000 square feet) does not exceed 50 $ppm_v$.

- Flux Chamber Monitoring – For human health and ecological risk assessment purposes, and although not required by SCAQMD Rule 1150.2, landfill gas emissions will be collected from an isolated soil surface area using an emission isolation flux chamber. The location and number of flux chamber samples will be determined after the review of the surface emission and soil gas sampling results.

- Ambient Air Sampling – Ambient air sampling will be performed at the perimeter of Site 3 to evaluate the potential for off-site atmospheric impacts associated with landfill gas emissions.

- Landfill Gas Migration – Lateral migration of landfill gas will be evaluated during the soil gas survey by collecting samples at not less than 1,000 feet spacing outside the fill areas and along the perimeter of the site from approximate depths of 10, 25, and 40 feet.

The general locations for Phase II RI sampling of air emissions at Site 3 correspond with areas of suspected landfilled waste, as depicted in Figure C-7. These will be refined as information is generated from geophysical surveys associated with defining landfill limits.

## Unit 1: Landfill Area– Groundwater Quality

Landfills, through leachate production and migration, liquid waste migration, and surface water percolation and transport of contaminants, have the potential for impacting groundwater. This portion of the Phase II RI assesses current groundwater quality at the site, whether the landfilled wastes have impacted groundwater, and establishes a compliance monitoring network. If groundwater impacts are observed as a result of Phase II investigations, additional wells may be constructed and sampled to estimate the extent of groundwater degradation. For risk assessment purposes, the contaminant concentrations in groundwater will be compared with U.S. EPA maximum concentration levels, as per the Safe Drinking Water Act

Aside from answering the question of whether groundwater is impacted from landfilled wastes, data collected in this phase will also be used to conceptually design engineered remedial option(s), if impacts have occurred. The following techniques will be used to achieve these goals.

- Existing wells will be sampled and analyzed for COPCs; groundwater elevations will also be measured to estimate gradient and flow direction.
- New wells will be installed where necessary to estimate groundwater gradient and flow direction at the site, and to help assure sampling of groundwater downgradient from landfilled wastes. These new wells will also be sampled and analyzed for COPCs.
- Results from the above activities will be used to determine if groundwater impacts exist.

The analytical results of the existing groundwater monitoring wells will be assessed to determine whether the existing groundwater monitoring network is sufficient to ascertain if the landfill is the source of the groundwater contamination in the immediate area.

To assess the need for an additional well(s), one round of samples will be collected from existing groundwater monitoring wells. The samples will be analyzed for COPCs listed in Step 3.

Based on the results of Tier 1 activities, an additional groundwater monitoring well may be installed.

If groundwater contamination is observed from Site 3, additional Tier 2 field investigations will be performed, as necessary, to obtain site-specific data for the following objectives:

- estimating the lateral and vertical extent of groundwater contamination;
- documenting seasonal variations in groundwater elevations; and
- performing aquifer tests to collect hydrogeological parameters necessary for evaluating possible groundwater containment or remediation.

## Unit 1: Landfill Area– Sample Vadose Zone Below Landfill

As suggested in the previous subsection, groundwater may be threatened due to migrating leachate or liquid wastes. Vadose zone monitoring equipment (i.e., soil vapor probe) will be installed in selected borings to assess the migration of landfill contaminants for vadose zone compliance monitoring. The soil samples collected during drilling will be analyzed for the COPCs identified in the DQO. For compliance monitoring, two vadose zone borings will be advanced under the landfill and equipped with vapor probes.

The final number and locations of these borings will depend on the results of the groundwater surface geophysics and soil gas investigations.

At the conclusion of groundwater related activities the following Tier 2 activities will be performed, as necessary: A minimum of two slanted borings will be drilled and sampled adjacent to the main disposal area of Site 3. The borings will be cased and a permanent sampling probe will be installed in the borings to collect leachate and/or gas that has migrated beneath the refuse into the vadose zone.

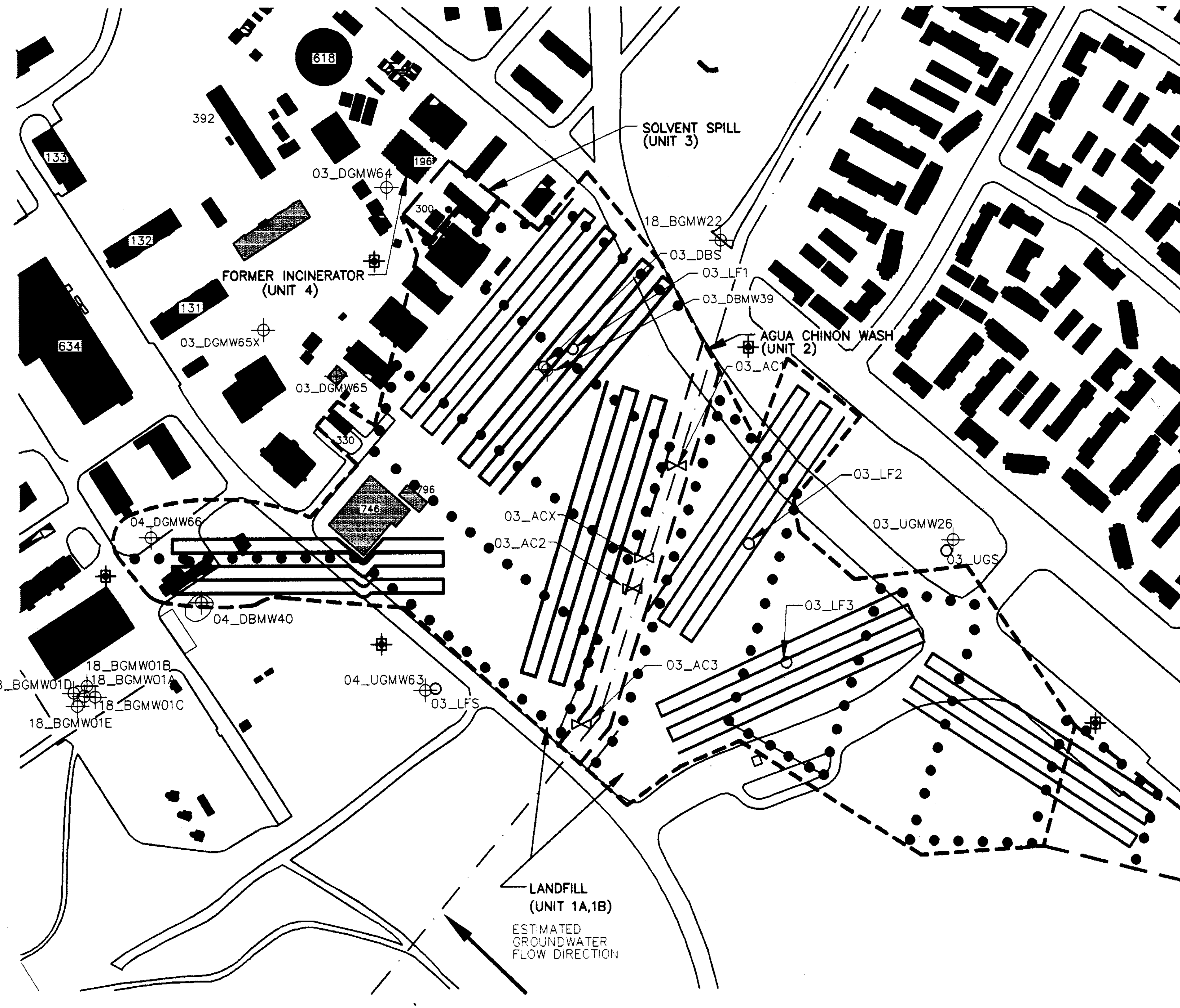
## Unit 2: Agua Chinon Wash – Evaluate Site for Hot Spots

The soil gas sampling program described for Unit 1, Tier 1, will cover Agua Chinon Wash through Site 3 (Figure C-2). Soil gas samples will be collected to assess potential VOCs in the soil beneath the wash.

To evaluate the presence of hot spots underneath the wash as part of Unit 2, Tier 1 tasks, the first soil gas sample locations will be selected independently and randomly and the remaining points will be selected at spacings of 200 feet from the first sampling point. Soil gas samples will be collected at a depth of 15 feet.

## Unit 2: Agua Chinon Wash – Investigate Impacts to and from Surface Water

Agua Chinon Wash bisects Site 3. For this site, surface hydrologic investigation entails collecting and assessing data regarding where the wash is, its surrounding topography, its bed characteristics (e.g., roughness and permeability), proximity to landfilled wastes, and storm-event flow rates. Techniques used during the Phase II RI to investigate the surface hydrology of the wash include:




**Work Plan Appendix C**
**Figure C-7**
**Air Sampling Plan**
**Site 3 - Original Landfill**

**MCAS El Toro, California**

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- review and field-confirmation of topographic maps;
- field assessment of bed characteristics using visual observations combined with surface hydrology handbook data;
- mapping the limits of landfilled waste relative to wash location and bed limits (horizontal and vertical); and
- use of historic regional storm-event data, coupled with short-term gauging of the wash, to estimate wash storm-event hydrology (i.e., runoff and flow rate).

Waters within the wash have the potential to cause or accelerate the release of COPCs by:

- eroding landfill cover and thus exposing buried wastes;
- transporting and dispersing exposed wastes downstream from the site; and
- transporting COPCs within and through subsurface soils, possibly resulting in groundwater contamination, through surface water percolation or the creation of leachate.

To investigate the impacts of the wash as part of Unit 2, Tier 1 tasks, three surface water samples will be collected after the first rainfall, if possible, and three sediment samples will be collected.

## Unit 3: Solvent Spill – Soil Gas Sampling

Soil gas samples will be collected to assess potential VOCs in the soil in the area solvent spill. As part of Unit 3, Tier 1 tasks soil gas sampling will be conducted on a 20-foot on-center grid across the site, to a depth of approximately 10 feet. Samples will be analyzed using an on-site mobile laboratory. Laboratory test results will be used to identify potential soil gas hot spots.

If surficial and shallow soil hot spots are identified during Tier 1 soil gas sampling, soil samples will be collected to identify the nature and extent of contamination. The number, location and depth of these borings will depend on Tier 1 findings and field conditions.

## Unit 3: Solvent spill – Shallow Soil Sampling

Surface and shallow soil samples will be collected and analyzed for COPCs to support the human health and ecological risk assessments. The surface and shallow soil samples will be collected at a depths of 0, 5, and 10 feet.

To evaluate the presence of contaminated soil as part of Unit 3, Tier 1 tasks, shallow soil samples will be collected from two locations at depths of 0, 5, and 10 feet. The location of these soil samples is shown on Figure C-3.

Additional Tier 2 soil samples may be collected based on the analytical results of Tier 1.

## Unit 4: Former Incinerator Site – Surface Geophysical Surveying

At the completion of the initial land survey, a surface geophysical survey will be conducted to better identify the location of the former incinerator.

## Unit 4: Former Incinerator Site – Soil Gas Sampling

Soil gas samples will be collected to assess potential VOCs in the soil in the area of the former incinerator. As part of Unit 3, Tier 1 tasks, soil gas sampling will be conducted on a 10-foot on-center grid across the site, to a depth of approximately 15 feet. Samples will be analyzed using an on-site mobile laboratory. Laboratory test results will be used to identify potential soil gas hot spots.

If surficial and shallow soil hot spots are identified during Tier 1 soil gas sampling, soil samples will be collected to identify the nature and extent of contamination. The number, location and depth of these borings will depend on Tier 1 findings and field conditions.

## Unit 4: Former Incinerator Site – Surface and Shallow Soil Sampling

Surface and shallow soil samples will be collected and analyzed for COPCs to support the human health and ecological risk assessments. The surface and shallow soil samples will be collected at a depths of 0, 5, and 10 feet bgs.

To evaluate the presence of contaminated soil, the following Unit 4, Tier 1 tasks will be performed: collect shallow soil samples from three locations at depths of 0, 5, and 10 feet bgs. The location of these soil samples is shown on Figure C-3.

Additional Tier 2 soil samples may be collected based on the analytical results of Tier 1.

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Jacobs Engineering Group, Inc. 1993a. *Installation Restoration Program, Final Resource Conservation and Recovery Act (RCRA) Facility Assessment Report.* Marine Corps Air Station El Toro, California.

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RWQCB. *See* California Regional Water Quality Control Board.

SAIC. *See* Science Applications International Corporation.

SCAQMD. 1989. "Guidelines for Implementation of Rule 1150.1." South Coast Air Quality Management District, El Monte, California.

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Strata. *See* Strata Technologies Incorporated.

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United States Environmental Protection Agency. 1993a. "Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process." Quality Assurance Management Staff, Washington D.C.

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U.S. EPA. *See* United States Environmental Protection Agency.

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# DATA QUALITY OBJECTIVES
# OPERABLE UNIT 2 –
# SITE 4 – FERROCENE SPILL AREA

# SUMMARY

Site 4, the Ferrocene Spill Area, is designated as a Removal Action site. Units 1 and 2 (which consist of the entire site) at Site 4 are considered under the Removal Action. Site 4 was designated for Removal Action process in June 1995. Because Site 4 is in the Removal Action process, it will not be addressed in the Phase II Remedial Investigation/Feasibility Study. The background information provided in this appendix has been presented to provide an understanding of the Site 4 history prior to its inclusion in the Removal Action Process. Site 4 is designated as a Non-Time-Critical Removal Action and an Engineering Evaluation/Cost Analysis and Action Memorandum are being prepared for the site.

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# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| bgs | below ground surface |
| COPC | chemical of potential concern |
| DQO | data quality objective |
| FS | Feasibility Study |
| LUFT | (California) Leaking Underground Fuel Tank (Field Manual) |
| MCAS | Marine Corps Air Station |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| PCB | polychlorinated biphenyl |
| PRG | (U.S. EPA Region IX) Preliminary Remediation Goal |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| SAIC | Science Applications International Corporation |
| SVOC | semivolatile organic compound |
| TAL | target analyte list |
| TFH | total fuel hydrocarbons |
| TRPH | total recoverable petroleum hydrocarbons |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |

## ACRONYMS/ABBREVIATIONS (continued)

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## Appendix D
# SITE 4 – FERROCENE SPILL AREA

## Site Description

Site 4, the Ferrocene Spill Area, is located in the northeast quadrant of Marine Corps Air Station (MCAS) El Toro, adjacent to 9th Street and immediately southeast of Building 658, a jet engine testing facility (Figure D-1). Site 4 comprises two noncontiguous areas: 1) an oil-stained area; and 2) a drainage ditch. Site boundaries for MCAS El Toro Phase I Remedial Investigation (RI) were determined by consensus between the Navy and the regulatory agencies prior to initiation of the Phase I RI. Areas of concern were generally grouped together as sites based on common historical activities, aerial photograph review, and their respective locations to each other.

During washing of a 500-gallon tank in August 1983, the liquid contents apparently overflowed and spilled onto the ground, draining into a ditch adjacent to the street (Jacobs Engineering 1993a). A catch basin at the southeast end of the ditch is part of the Station storm drainage system and discharges into nearby Agua Chinon Wash. The spilled liquid reportedly contained approximately 5 gallons of ferrocene and hydrocarbon carrier solution. Ferrocene (dicyclopentadienyl iron - $C_{10}H_{10}Fe$) is an organic compound used as an antiknock additive and catalyst in gasoline and jet fuel. It takes the form of an orange crystalline solid at atmospheric temperature and pressure. This crystalline solid is relatively insoluble in water, but is soluble in such volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) as alcohol, ether, and benzene (Jacobs Engineering 1993a).

In addition to the ferrocene spill, the site is characterized by a stained area that resulted from oily discharge emanating from Building 658. This discharge was observed over at least a two-year period. Based upon the types of activities taking place at Building 658, the discharges may have consisted of heavy oils, solvents, and fuels (Jacobs Engineering 1993a).

## Previous Investigations

Several investigations have been conducted in the area of Site 4, including the Phase I RI and aerial photographic surveys. The sections below provide a summary of these investigations.

### PHASE I REMEDIAL INVESTIGATION

For the Phase I RI, subareas within sites were designated as strata. Due to the fact that some new subareas have been added or subareas have been expanded or diminished for the Phase II RI/Feasibility Study (FS), subareas within sites will be referred to as units for the Phase II RI/FS. In this section, discussion is related to Phase I RI sampling and results and the term strata will be used. Following this section, the term unit will be used.

For the Phase I RI, Site 4 was reported by two strata:

- Stratum 1 – the Stained Area identified in the 1987 MCAS El Toro Oil and Hazardous Substance Spill Prevention Control and Countermeasure Plan (Jacobs Engineering, 1993a); and
- Stratum 2 – the Drainage Ditch into which liquid from the ferrocene spill drained.

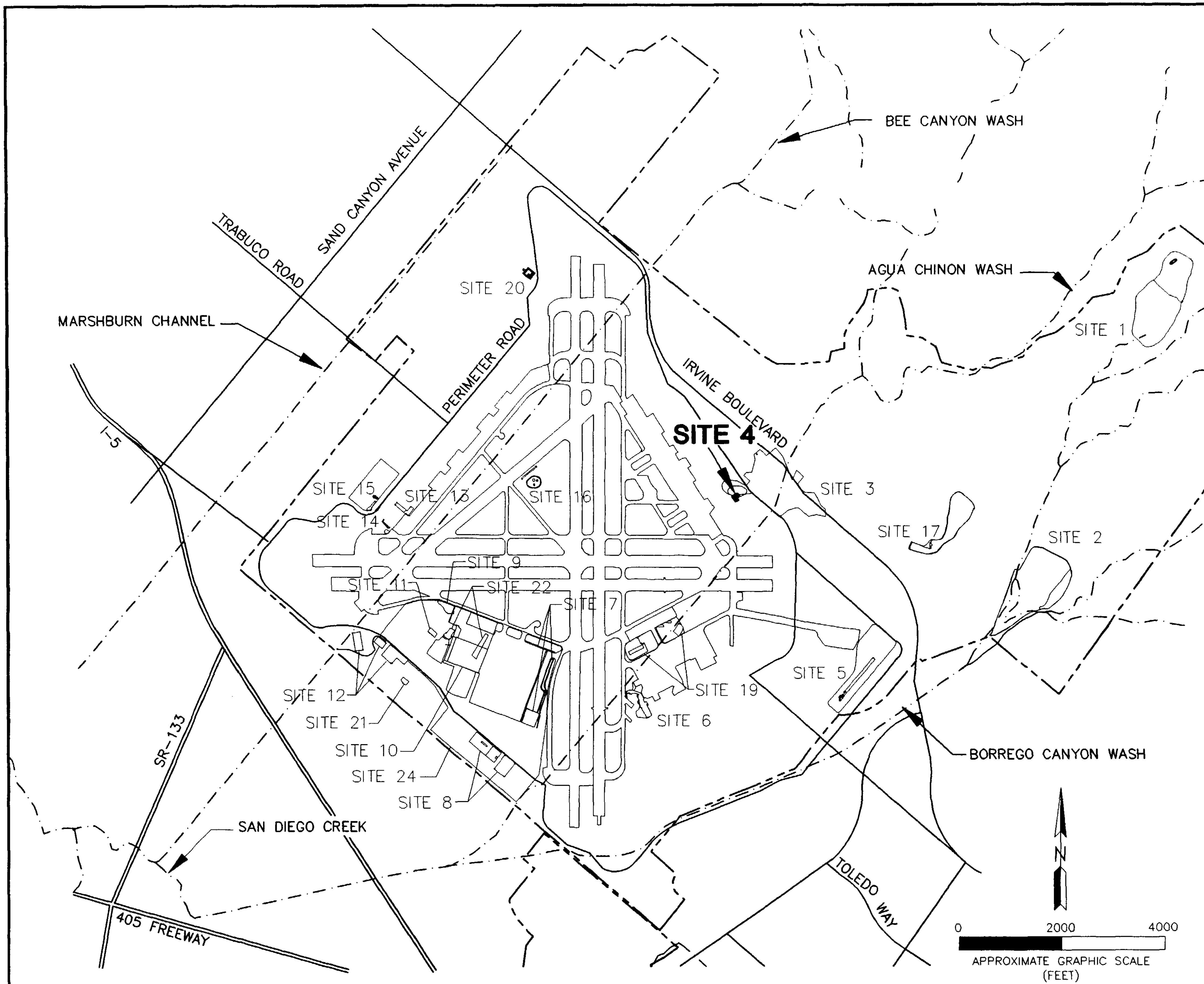
The following site-specific activities were conducted during the Phase I RI:

- the collection of shallow soil samples (0, 2 and 4 feet below ground surface [bgs]) for chemical analyses from 3 locations each in Strata 1 and 2;
- the collection of a sediment sample from the catch basin within Stratum 2;
- the development, installation, and sampling of one upgradient and two downgradient monitoring wells;
- the analysis of soil samples for target analyte list (TAL) metals, VOCs, SVOCs, pesticides/polychlorinated biphenyls (PCBs), total fuel hydrocarbons (TFH), and total recoverable petroleum hydrocarbons (TRPH); and
- the analysis of groundwater samples for general chemistry, VOCs, SVOCs, herbicides, pesticides/PCBs, cyanide, gross beta (upgradient well only).

A summary of the ranges of analyte concentrations detected during the Phase I RI, plus recent groundwater monitoring data are presented below. All chemicals of potential concern (COPCs) that were detected in soil are listed, with the exception of specific metals, which are listed only if U.S. EPA Region IX Preliminary Remediation Goals (PRGs) or ecological screening criteria in shallow soil were exceeded. All COPCs exceeding PRGs or MCLs in groundwater are included in this list. If a minimum concentration is recorded with a "less than" symbol, it denotes a concentration below the contract laboratory program detection limit. Sample locations are shown on Figure D-2. A complete listing of all detected chemicals is presented in the Phase I RI Technical Memorandum, Appendix B-4, Tables B4-2 through B4-7, (Jacobs Engineering 1993a), and in the Groundwater Quality Data Report (Jacobs Engineering 1994a). TAL metals that were analyzed during the Phase I RI are beryllium, barium, arsenic, antimony, aluminum, cadmium, calcium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

### *Shallow Soil (less than 10 feet below ground surface)*

- metals: lead (0.96 to 258 milligrams per kilogram [mg/kg]), mercury (< 0.03 to 0.84 mg/kg), zinc (13.3 to 529 mg/kg) and 19 other TAL metals;
- VOCs: acetone (< 10 to 24 micrograms per kilogram [μg/kg]), toluene (< 10 to 27 μg/kg) xylenes (< 10 to 100 μg/kg);




**Work Plan Appendix D**
**Figure D-1**
**Site Location**
**Site 4 - Ferrolene Spill Area**

MCAS El Toro, California

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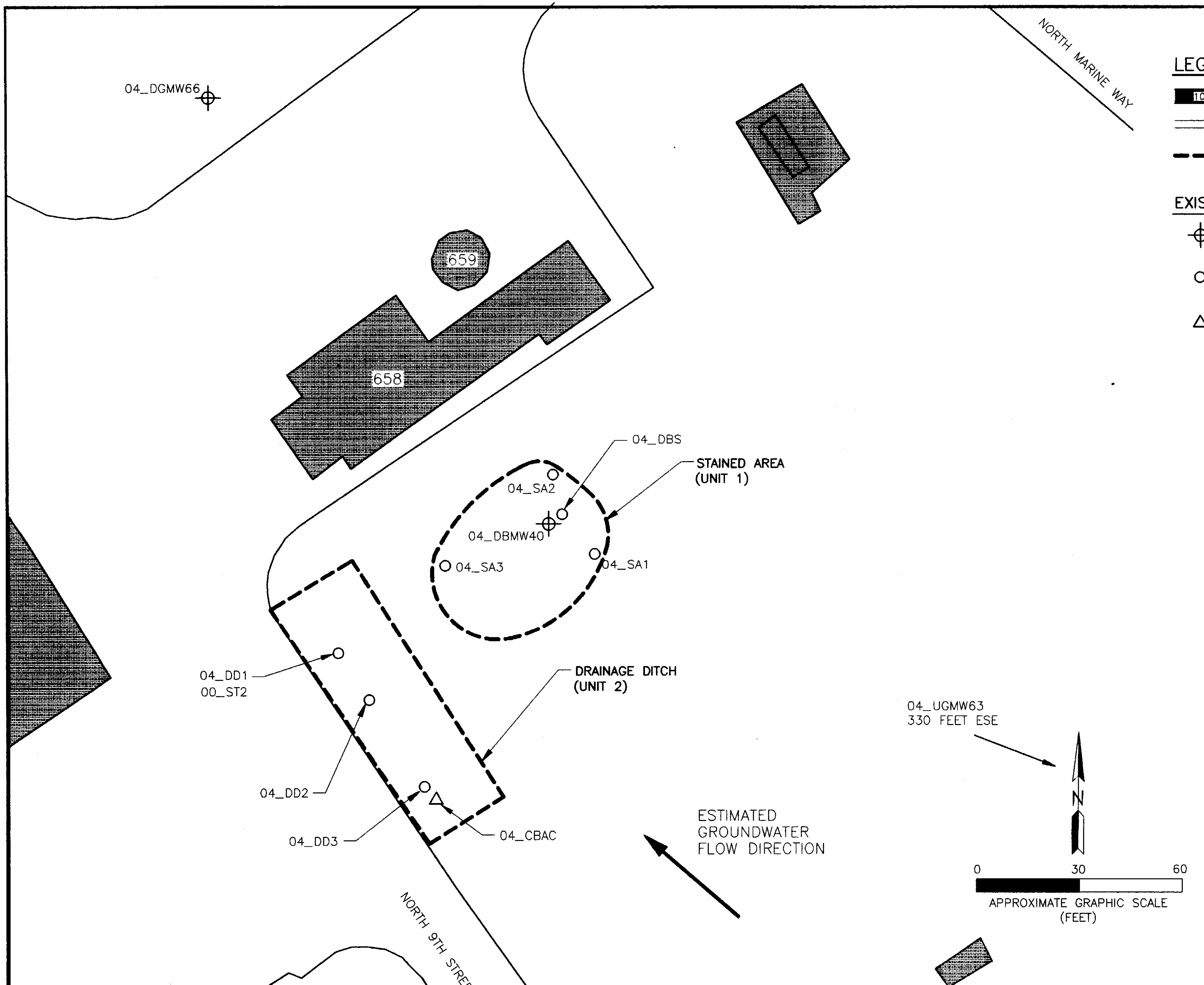


**Work Plan Appendix D**

**Figure D-2**
**Site Plan**
**Site 4 - Ferrocene Spill Area**

**MCAS El Toro, California**

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- SVOCs: 2-methylnaphthalene (< 680 to 2,900 μg/kg), benzo(a)pyrene (< 680 to 220JB μg/kg), benzo(b)fluoranthene (< 680 to 240J μg/kg), benzo(k)fluoranthene(< 680 to 270J μg/kg), benzyl butyl phthalate(< 680 to 150J μg/kg), bis(2-ethylhexyl) phthalate(< 680 to 380J μg/kg), chrysene (< 680 to 220J μg/kg), fluoranthene(< 680 to 190J μg/kg), naphthalene (< 680 to 23,000 μg/kg), phenol (< 680 to 270J μg/kg), pyrene (< 680 to 210J μg/kg);

- pesticides and PCBs: 4'4-dichlorodiphenyldichloroethane (< 3.4 to 42.4 μg/kg), 4'4'-dichlorodiphenyldichloroethene (< 3.36 to 15.8J μg/kg), 4,4'-dichlorodiphenyltrichloroethane (< 3.4 to 58.2J μg/kg), alpha chlordane(< 1.75 to 4.86J μg/kg), BHC-delta (< 1.75 to 2.47J μg/kg), dieldrin (< 3.4 to 32.8J μg/kg), endosulfan I (< 1.75 to 0.763J μg/kg), endosulfan II (< 3.4 to 14.1J μg/kg), endosulfan sulfate (< 3.4 to 0.926J μg/kg), endrin (< 3.4 to 13J μg/kg), endrin aldehyde (< 3.4 to 8.78J μg/kg), endrin ketone (< 3.4 to 7J μg/kg), gamma chlordane (< 1.75 to 8.11J μg/kg), methoxychlor (< 17.5 to 3.36J μg/kg); and

- fuel and petroleum hydrocarbons: TFH-gasoline (< 0.05 to 3.11 mg/kg), TFH-diesel (< 12.7 to 16,400 mg/kg).

### *Subsurface Soil (greater than 10 feet below ground surface)*

- metals: lead (< 1.2 to 28.3 mg/kg), mercury (< 0.03 to 0.22 mg/kg), zinc (13.3 to 48.7 mg/kg) and 18 other TAL metals;

- VOCs: acetone (< 11 to 19 μg/kg), toluene (< 10 to 3J μg/kg);

- SVOCs: bis(ethylhexyl)phthalate (< 720 to 250J μg/kg); and

- fuel and petroleum hydrocarbons: TFH-gasoline (< 0.05 to 0.83 mg/kg), TRPH (< 20 to 249 mg/kg).

### *Groundwater (04_UGMW63 upgradient)*

- general chemistry: nitrate/nitrite-N (11.8 to 12.4 milligrams per liter [mg/L]), TDS (993 to 1,080 mg/L);

- metals: aluminum (10.5B to 31.3B micrograms per liter [μg/L]), antimony (< 22 to 14.7 μg/L), arsenic (0.9B to 2.4 μg/L), manganese (337 to 359 μg/L), nickel (< 7.1 to 17.1B μg/L), selenium (8.2 to 12.2 μg/L), and 8 other 23 TAL metals;

- VOCs: benzene (3 to 4 μg/L), methylene chloride (0.6J to 2 μg/L);

- herbicides: 2,4,5 T (0.94 μg/L*);

- fuel hydrocarbons: TFH-diesel (< 250 to 439 μg/L); TFH-gasoline (< 50 to 522 μg/L); and

- gross beta: gross beta (11.3 picocuries per liter *).

***Groundwater (04_DBMW40 on-site)***

- general chemistry: nitrate/nitrite-N (10.3 to 12.8 mg/L), total dissolved solids (TDS) (940 to 1,000 mg/L);
- metals: aluminum (8B to 69B µg/L), arsenic (1.9B to 2.7B µg/L), manganese (11.7B to 33.5 µg/L), nickel (39.4B to 55.9 µg/L), selenium (13.6B to 20.2B µg/L), and 9 other 23 TAL metals;
- VOCs: 2-hexanone (< 2 to 7 µg/L), benzene (< 1 to 4 µg/L), xylenes (< 1 to 3 µg/L); and
- fuel hydrocarbons: TFH-diesel (< 250 to 769 µg/L); TFH-gasoline (77.7 to 282J µg/L).

***Groundwater (04_DGMW66 downgradient)***

- general chemistry: nitrate/nitrite-N (6.52 to 9.17 mg/L), TDS (730 to 770 mg/L); and
- metals: aluminum (< 31 to 8B µg/L), arsenic (2.8B to 3.1 µg/L), manganese (4.8B to 16.8 µg/L), nickel (107 to 136 µg/L), selenium (14B to 17.4B µg/L), and 7 other TAL metals.

* = Indicates analysis only conducted for one sampling event.

J = Indicates an estimated value for qualitative use only (organic parameters).

B = Indicates reported value is less than the contract-required detection limit, but greater than the or equal to the instrument detection limit (inorganic parameters).

Concentrations of COPCs detected in shallow soil at Site 4 during Phase I RI were compared to PRGs and ecological screening criteria. The results of this comparison are shown below (Jacobs Engineering 1993b):

- no COPCs exceed either PRGs or ecological criteria in shallow soil in Stratum 1;
- benzo(a)pyrene and dieldrin exceed PRGs; and benzo(a)pyrene, lead, mercury, and zinc exceed ecological criteria in shallow soil in Stratum 2; and
- TFH-diesel exceeds California Leaking Underground Fuel Tank (LUFT) Field Manual (LUFT 1989) criteria in Stratum 2.

No COPCs that pose a potential risk to groundwater were identified in deeper subsurface soils beneath Site 4.

Groundwater samples were collected from three groundwater monitoring wells (04_UGMW63, 04_DBMW40, and 04_DGMW66) constructed at or near Site 4. PRGs and ecological screening criteria for the site were compared to corresponding groundwater sample analytical results (Jacobs Engineering 1994a). The results of this comparison are as follows:

- benzene, arsenic, manganese, and nitrate/nitrite-N exceed PRGs, and antimony, benzene manganese, nitrate, and TDS exceed MCLs in the upgradient well 04_UGMW63;
- arsenic and nitrate/nitrite-N exceed PRGs; and aluminum, nitrate/nitrite-N, selenium, and TDS exceed MCLs in the on-site well 04_DBMW40; and
- arsenic and nitrate/nitrite-N exceed PRGs; and nickel, selenium, and TDS exceed MCLs in downgradient well 04_DGMW66.

### U.S. EPA AERIAL PHOTOGRAPH SURVEY

Aerial photographs reviewed by U.S. EPA showed no features related to the Ferrocene Spill (Jacobs Engineering 1993b).

### SAIC AERIAL PHOTOGRAPH SURVEY

The Science Applications International Corporation aerial photograph survey identified an open storage area near Building 658 in the 1973 photograph and identified probable stains on the southern side of Building 658 in the 1984 photograph. These features are probably not related to the Ferrocene Spill Area (SAIC 1993).

## Geology

The geology of Site 4 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993a). Holocene deposits consist of fine-grained overbank deposits and coarse-grained stream channel deposits. The soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene. The Miocene to Pliocene formations are considered to be bedrock in the area. Based on a review of the Phase I RI boring logs, the subsurface lithology consists of well graded to silty sand, interbedded with silt and clay. Within the sand units are occasional gravel lenses which may be associated with stream channels.

## Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Basin, a subbasin of the Los Angeles groundwater basin. Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993a).

The Phase I RI results indicate that a shallow, perched zone is not present at Site 4. The principle aquifer is present beneath Site 4 at a depth of about 220 feet bgs. The groundwater flow beneath Site 4 is to the northwest with a hydraulic gradient that ranges from 0.0024 to 0.008. The hydraulic gradient and flow direction are strongly influenced by large pumping depressions located off-Station to the west.

The primary release mechanism is the surficial release of contaminants to shallow soil resulting from historic waste disposal activities and spills at this site. Eventually under gravity, contaminants present in shallow soil may move downward with soil moisture (in dissolved phase) or in a liquid phase. Owing to the small volume of the spill containing wash water, ferrocene, and hydrocarbon carrier; coupled with the relative insolubility of ferrocene in water, its potential mobility in the environment is probably slight. The depth of groundwater is recorded to be about 220 to 225 feet bgs.

The secondary source of contaminants is the surrounding soil impacted by disposal activities. The secondary release mechanism is the dust brought into suspension in the air. The fine particles of dust may contain all potential contaminants. Storm water runoff may form another secondary release mechanism. Storm water carries contaminants in dissolved forms, colloidal forms, or associated with suspended soil particles.

The potential pathways are air, groundwater, and surface water. Airborne contaminants are transported through fugitive dust and volatilization. The transport through air is affected by wind speed and direction, type of contaminant, and weather condition. Typical wind condition at MCAS El Toro is from west/southwest at less than 10 knots. Transportation of airborne contaminants through volatilization is expected to be largely unimportant at this site. Surface water transport is affected by the amount of rainfall, type of contaminant, surface soil properties and the topography of the area. The mean annual rainfall at MCAS El Toro is about 14.0 inches; most of it occurs from November through April.

Current and/or potential receptors of chemicals at this site via inhalation are workers and visitors involved in disposal activities. Direct contact with surface and subsurface soils is currently possible via dermal or ingestion exposures of workers. Infiltration of contaminated water through the vadose zone into groundwater is possible because subsurface soil is mainly sands, with some silts and clays. However, current exposure of workers is unlikely via ingestion of groundwater at this site.

Terrestrial wildlife could be exposed to chemicals in on-site surface soil, and dust and vapors through ingestion, dermal absorption or inhalation. Terrestrial plants could also be exposed through root absorption of chemicals in surface soil or deposition of dusts. No special-status species were observed at this site, and the immediate area provides marginal habitat for wildlife species.

## Removal Action

In meeting with the BRAC Cleanup Team (BCT) during June 1995, Site 4 was designated as a Removal Action site. This designation occurred because the nature and extent of contaminants is known and criteria of a Non-Time-Critical Removal Action were satisfied (Section 5 of the Work Plan). An Engineering Evaluation/Cost Analysis, Action Memorandum, and community relations are being prepared for this Removal Action.

# References

Jacobs Engineering. *See* Jacobs Engineering Group, Inc.

Jacobs Engineering Group, Inc. 1993a. *Installation Restoration Program, Phase I Remedial Investigation Draft Technical Memorandum.* Marine Corps Air Station El Toro, California.

———. 1993b. *Installation Restoration Program, Phase II Remedial Investigation/Feasibility Study, Draft Work Plan.* Marine Corps Air Station El Toro, California.

———. 1994a. *Groundwater Quality Data Report.* Marine Corps Air Station El Toro, California.

Jacobs Engineering. *See* Jacobs Engineering Group, Inc.

LUFT. *See* State of California Leaking Underground Fuel Tank Task Force.

SAIC. *See* Science Applications International Corporation.

Science Applications International Corporation. 1993. *Final Report Aerial Photograph Assessment, Marine Corps Air Station El Toro, El Toro, California*. Science Applications International Corporation.

State of California Leaking Underground Fuel Tank Task Force. 1989. *Leaking Underground Fuel Tank Field Manual: Guidelines for Site Assessment, Cleanup, and Underground Storage Tank Closure.*

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# WORK PLAN APPENDIX E

## DATA QUALITY OBJECTIVES
## OPERABLE UNIT 2 –
## SITE 5 – PERIMETER ROAD LANDFILL

# SUMMARY

## STEP 1 – STATE THE PROBLEM

The problem at Site 5, Perimeter Road Landfill, is to determine which components of the United States Environmental Protection Agency presumptive remedies (which include capping, groundwater treatment, gas control and treatment, or deed restrictions) are appropriate, and confirm past groundwater sampling results.

## STEP 2 – IDENTIFY THE DECISION

Decisions to be considered regarding environmental conditions at Site 5 are the following: Have the limits of the landfilled wastes been defined? Are the action levels for ambient air exceeded? Has the landfill impacted surface water or sediment? Have principal waste "hot spots" been identified within the landfill? Do data indicate that leakage from the landfill has impacted groundwater or subsurface soil? Has the nature and extent of chemicals of potential concern in groundwater been defined?

## STEP 3 – IDENTIFY THE INPUTS AFFECTING THE DECISION

Inputs necessary to make the decisions listed in Step 2 include a list of chemical constituents to be analyzed; an assessment of subsurface soil to evaluate potential landfill leakage; a definition of the limits of solid waste; and an assessment of potential hot spots, the nature and extent of chemicals of potential concern in groundwater, and landfill gas emission.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

The study is geographically limited to the Perimeter Road Landfill and the stored waste that was derived from the Phase I Remedial Investigation.

## STEP 5 – DEVELOP A DECISION RULE

Action levels developed for decision-making purposes are a cumulative excess cancer risk of $10^{-6}$ in humans, a hazard index of 1.0 for chronic systemic toxicity in humans, and a hazard index of 1.0 for acute and chronic toxicity for other organisms. Based on these risk levels, decision rules are developed to protect human health and the environment in residential, industrial, and recreational land use scenarios.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The sampling designs proposed for Site 5 are areal systematic random sampling and judgmental. An areal systematic random sampling design will be used to characterize the nature and extent of a problem and detect "hot spots." The initial round of sampling will be on a 200-foot grid spacing, providing an 80-percent confidence of hitting a circular "hot spot" having a radius of 100 feet (Gilbert 1987). Judgmental sample locations will be based on previous data and regulatory guidelines.

## STEP 7 – OPTIMIZE THE DESIGN

Samples to be collected for the Phase II Remedial Investigation/Feasibility Study will support the remedial response for municipal landfill sites. Generally, activities to be performed include surface geophysics, soil gas sampling, air sampling, vadose zone sampling, groundwater sampling, and well installation.

# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| Air SWAT | Air Quality Solid Waste Assessment Test |
| bgs | below ground surface |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CFR | *Code of Federal Regulations* |
| COPC | chemical of potential concern |
| DDT | dichlorodiphenyltrichloroethane |
| DQO | data quality objective |
| EM | electromagnetic |
| FS | Feasibility Study |
| IDW | investigation-derived waste |
| MCAS | Marine Corps Air Station |
| MCL | maximum contaminant level |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| ND | nondetect |
| PCE | perchloroethene (tetrachloroethene) |
| pCi/L | picocuries per liter |
| $\%_v$ | percent by volume |
| $ppb_v$ | parts per billion by volume |
| $ppm_v$ | parts per million by volume |
| PRG | (U.S. EPA Region IX) Preliminary Remediation Goal |
| RD | Remedial Design |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| RWQCB | (California) Regional Water Quality Control Board |
| SAIC | Science Applications International Corporation |
| SCAQMD | South Coast Air Quality Management District |
| SVOC | semivolatile organic compound |

## ACRONYMS/ABBREVIATIONS (continued)

| | |
|---|---|
| TAL | target analyte list |
| TCE | trichloroethene |
| TDS | total dissolved solids |
| TFH | total fuel hydrocarbons |
| TOC | total organic compound |
| TRPH | total recoverable petroleum hydrocarbons |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |

## Appendix E
# SITE 5 – PERIMETER ROAD LANDFILL

The United States Environmental Protection Agency (U.S. EPA) developed the data quality objective (DQO) process as a tool for project managers to determine the type, quantity, and quality of data needed to make decisions. Data produced by sampling and monitoring activities are used extensively in problem definition, rule-making, and enforcement decisions. These activities are supported through implementation of the mandatory U.S. EPA Quality System, which requires all organizations to develop and operate management processes and structures for assuring that the data collected are of the necessary and expected quality for their desired use. (U.S. EPA 1993a)

The U.S. EPA DQO process consists of the following seven steps:

1. **State the problem:** Describe the problem at the site as it is currently understood. The problem statement includes a site conceptual model and an organization and review of all relevant data.
2. **Identify the decision:** Determine an if-then statement that will define what the investigation will seek to determine and what actions will be taken based on the possible outcomes of the investigation.
3. **Identify inputs into the decision:** Specify the analytes or parameters to be measured and used.
4. **Define the study boundary:** Delineate the study boundary from information obtained from Step 1.
5. **Develop a decision rule:** Restate the decision detailing the if-then statement in specific terms.
6. **Specify acceptable limits on decision errors:** Specify how the data will be treated statistically and what the acceptable limits of uncertainty are.
7. **Optimize the design:** Design the field investigation, giving adequate consideration to the results of Steps 5 and 6. This step is described in more detail in the Field Sampling Plan.

The following sections describe the DQO process for Site 5 – Perimeter Road Landfill.

## STEP 1 – STATE THE PROBLEM

Site 5 consists of the Perimeter Road Landfill and the Phase I Remedial Investigation (RI) stockpiled investigation-derived waste (IDW) soil. Employee interviews suggest that the landfill encompasses a larger area than investigated during the Phase I RI; therefore, the current groundwater monitoring data may not be representative of the landfill's impact on water quality. Antimony, arsenic, and nitrate in groundwater exceed human health U.S. EPA Region IX Preliminary Remediation Goals (PRGs); antimony and gross alpha and gross beta particle activity exceed U.S. EPA drinking water primary maximum contaminant levels (MCLs). Trichloroethene (TCE), perchloroethene (PCE), and benzene were detected below human health PRGs and MCLs. It is not known if Site 5 is the source of these contaminants (Jacobs Engineering 1993a).

The problem at Site 5 is to determine which components of the U.S. EPA presumptive remedy (which included capping, groundwater treatment, gas control and treatment, and deed restrictions) are appropriate.

The following subsections briefly describe the site, summarize previously collected information, and present a conceptual site model.

## Site Description

Site 5, the Perimeter Road Landfill, is located in the southeast quadrant of Marine Corps Air Station (MCAS) El Toro, adjacent to the eastern property boundary and approximately 800 feet north-northwest of Borrego Canyon Wash. The site location is illustrated on Figure E-1. Site 5 was used from about 1955 to the late 1960s as a cut-and-fill operation, with landfilled waste volumes estimated at 50,000 to 60,000 cubic yards. Typically, wastes were burned prior to landfilling to reduce volume. The site encompasses a disposal area of approximately 65,000 square feet (1.5 acres). The Waste Storage Facility for the Phase I RI is located within and adjacent to the site boundaries.

Suspected wastes and contaminants included burnable trash, municipal solid waste, cleaning fluids, scrap metals, paint residues, and unspecified fuels, oils, and solvents. Almost any type of waste generated at MCAS El Toro may have been disposed of in this landfill.

## Previous Investigations

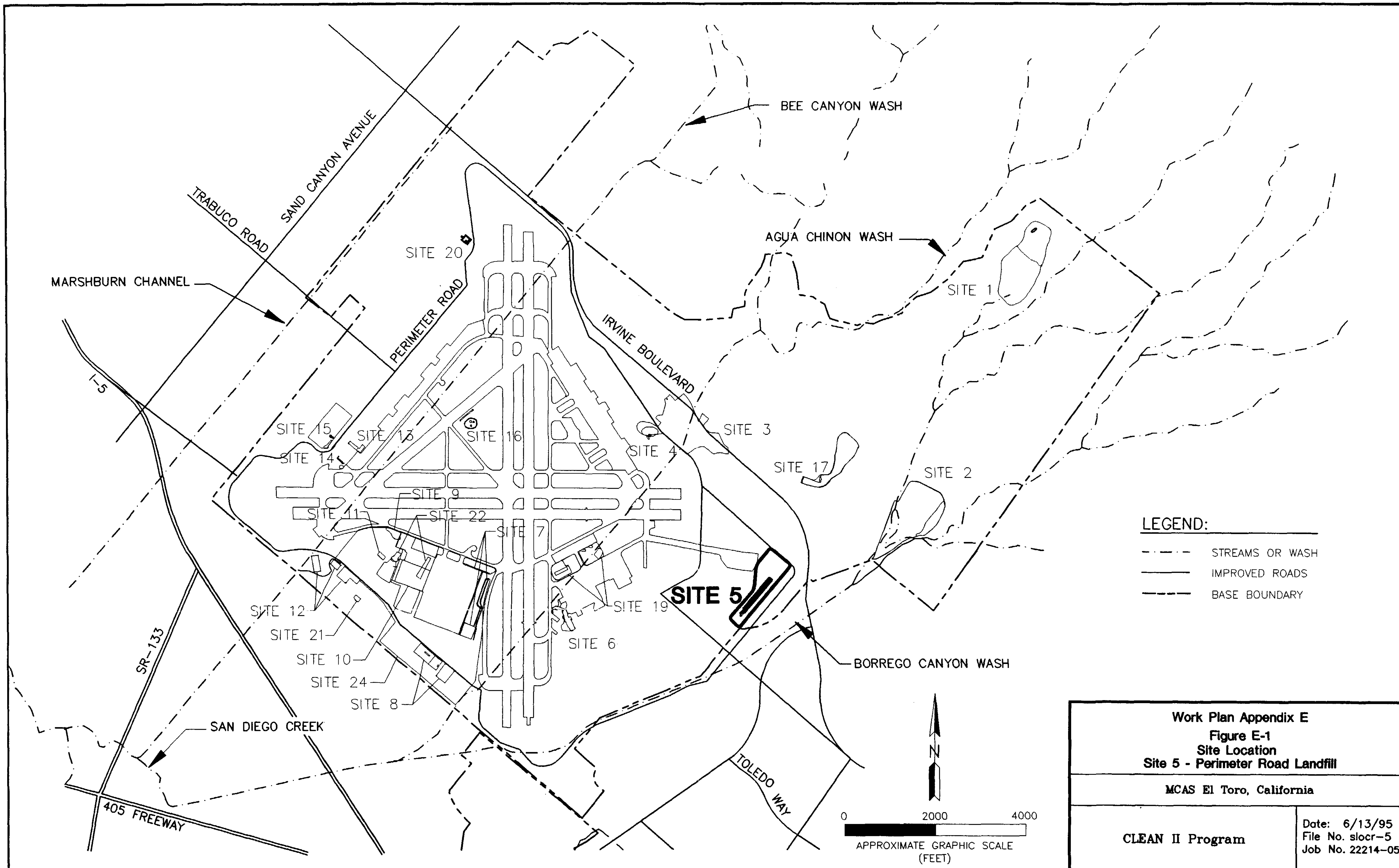
The following previous investigations are summarized below: the Phase I RI, employee interviews, U.S. EPA aerial photographic survey, Science Applications International Corporation (SAIC) aerial photographic survey, and the Air Quality Solid Waste Assessment Test (Air SWAT). A site plan is included as Figure E-2.

### PHASE I REMEDIAL INVESTIGATION

For the Phase I RI, subareas within sites were designated as strata. Due to the fact that some new subareas have been added or subareas have been expanded or added for the Phase II RI/Feasibility Study (FS), subareas within sites will be referred to as units for the Phase II RI/FS. In this section, discussion is related to Phase I RI sampling and results, and the term strata will be used. Following this section, the term unit will be used.

A summary of the Phase I RI activities included the following tasks:

- performing a geophysical survey to locate the landfill boundary;
- collecting shallow soil samples at five locations (upgradient and from an adjacent boring);
- drilling and sampling one deep boring completed as a monitoring well (05_DBMW41);
- drilling, installing, and sampling one upgradient monitoring well; and
- drilling, installing, and sampling two downgradient monitoring wells.




**Work Plan Appendix E**
**Figure E-1**
**Site Location**
**Site 5 - Perimeter Road Landfill**

**MCAS El Toro, California**

**CLEAN II Program**

Date: 6/13/95
File No. slocr-5
Job No. 22214-059

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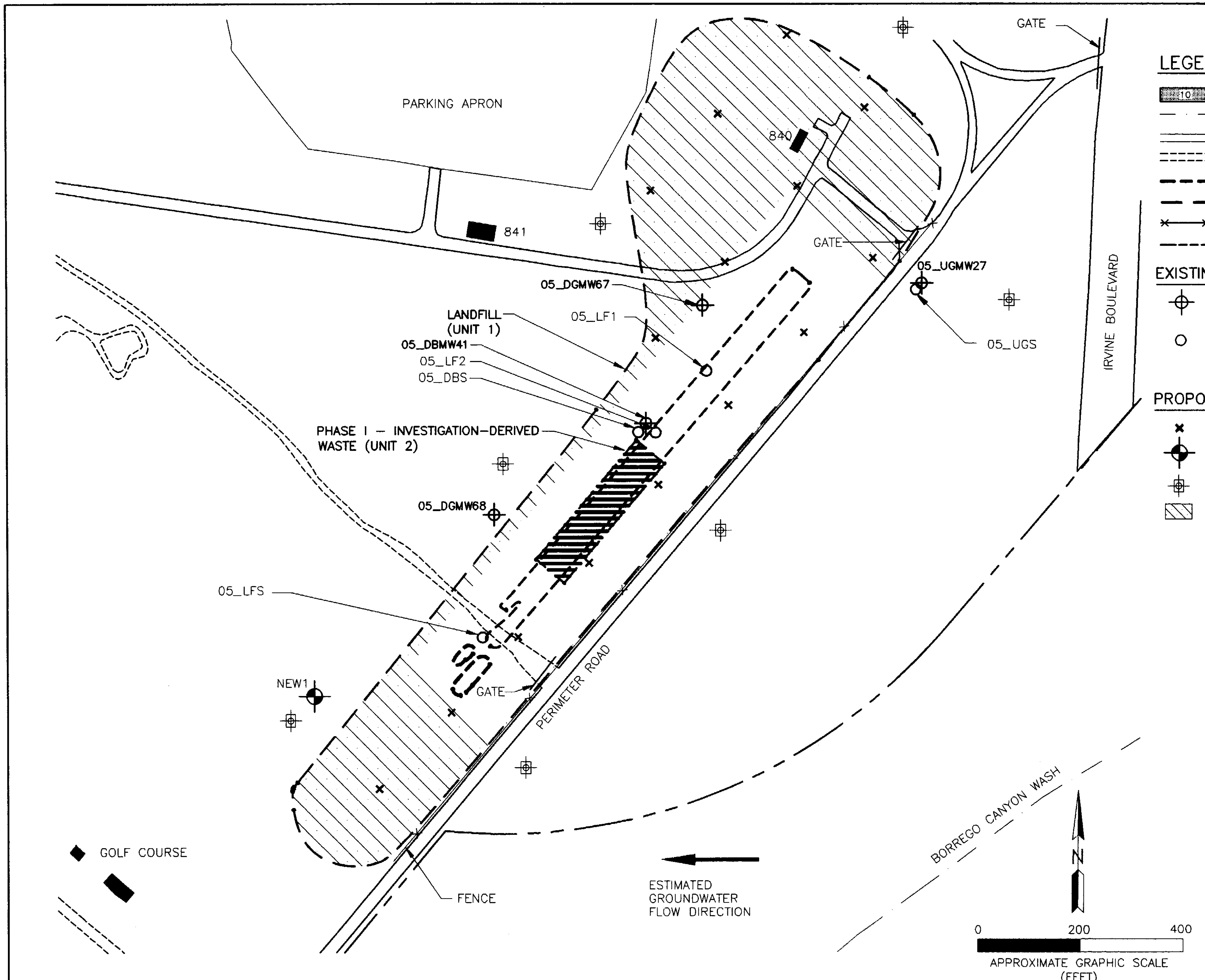


**Work Plan Appendix E**

**Figure E-2**
**Site Plan**
**Site 5 - Perimeter Road Landfill**

**MCAS El Toro, California**

**CLEAN II Program**

Date: 6/27/95
File No. siter5a
Job No. 22214-059

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Target analyte list (TAL) metals that were analyzed during the Phase I RI are beryllium, barium, arsenic, antimony, aluminum, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc. A summary of the Phase I analytical results (by medium and chemical class) is presented below.

### *Shallow Soil*

- Metals: arsenic (1.5B to 3.3 milligrams per kilogram [mg/kg] [05_LF3 at 0 feet]), beryllium (0.22B to 0.23B mg/kg [05_DBS at 0 feet]);
- volatile organic compounds (VOCs): toluene (< 10 to 4J micrograms per kilogram [μg/kg] [05_LF1 at 0 feet] [05_LF2 at 0 feet]);
- petroleum hydrocarbons: total recoverable petroleum hydrocarbons (TRPH) (< 20 to 877 mg/kg [05_LF3 at 0 feet]), total fuel hydrocarbons (TFH)-gasoline (< 0.05 to 0.083 mg/kg [05_LF2 at 0 feet]); and
- pesticides, polychlorinated biphenyls (PCBs), herbicides: 4,4'-dichlorodiphenyltrichloroethane (DDT) (< 3.34 to 239 μg/kg [05_LF3 at 0 feet]), methoxychlor (< 17.2 to 122 μg/kg [05_LF1 at 0 feet]), 2,4,5-trichlorophenoxyproprionic acid (TP) (silvex) (< 25.1 to 55.6 μg/kg [05_UGS at 0 feet]).

### *Subsurface Soil*

- Metals: arsenic (0.66B to 3.4 mg/kg [05_DBMW41 at 15 feet]);
- VOC: acetone (7J to 10J μg/kg [05_DGMW68 at 182 feet]);
- semivolatile organic compounds (SVOCs): bis(2-ethylhexyl) phthalate (< 680 to 430J μg/kg [05_UGMW27 at 114 feet]);
- petroleum hydrocarbons: TRPH (< 20 to 76 mg/kg [05_DGMW67 at 185 feet]), TFH-diesel (< 12.7 to 21.8 mg/kg [05_DGMW67 at 185 feet]); and
- pesticides, PCBs, herbicides: 4,4'-DDT (< 3.37 to 7.24 μg/kg [05_DBMW41 at 5 feet]), 2-(2-methyl-4-chlorophenoxy)-propionic acid (MCPP) (< 27,100 to 211,000 μg/kg [05_DBMW41 at 40 feet]).

### *Groundwater*

- Metals: antimony (< 12.1 to 20.8B micrograms per liter [μg/L] [05_DGMW68]), arsenic (1.4B to 4b μg/L [05_UGMW27]);
- VOC: benzene (< 1.0 to 0.3J μg/L [05_DGMW68]), chloromethane (< 0.5 to 2J μg/L [05_DBMW41]), methylene chloride (< 1.0 to 0.5J μg/L [05_DGMW68]), tetrachloroethene (< 0.8J to 0.9J μg/L [05_UGMW27), trichloroethene (< 1.0 to 0.6J μg/L [05_UGMW27]);
- herbicides: 2,4,5-T (< 0.25 to 0.69 μg/L [05_DGMW67]); and

- radionuclides: gross alpha (7 to 24.9 picocuries per liter [pCi/L] [05_DGMW67]), gross beta (5.9 to 53 pCi/L [05_DGMW67]).

## SUMMARY OF EMPLOYEE INTERVIEWS

On 26 May 1994, a meeting was held at MCAS El Toro to interview active and retired personnel from the Station Fuel Operations Division and Facility Management Department (currently the Installations Department) who would have extensive knowledge of Station operations and procedures from storage/disposal of hazardous materials and waste (Jacobs Engineering 1994a). Participating as interviewers during the meeting were agency personnel, Navy and Station personnel, and personnel from the contractors for the Navy and the U.S. EPA. A summary of these interviews follows.

- Disposal activities began in the early 1950s, and the landfill was closed in approximately 1975. It was stated that throughout the operating life of this landfill, the Station had contracted with an outside recycler to collect scrap metal from the landfill and dispose it off-Station. The interview panel suggested that despite the relative longevity of the landfill, its lateral size was kept limited because refuse was buried relatively deep (approximately 30 feet) and refuse burns frequently occurred. Liquid wastes were also commonly disposed at this landfill. Episodes of emptying 55-gallon drums of waste liquids into the landfill were noted.
- Members of the panel had no knowledge of radioactive material ever being disposed into the landfill.
- The panel agreed that all different types of waste were disposed into the landfill, including solid waste and liquid chemical wastes.
- It was stated that 55-gallon drums of miscellaneous waste fluids were emptied onto the unpaved ground.
- Some of the burn pits were as deep as approximately 30 feet below ground surface (bgs). Employees recounted that semitrucks and tractors driven into the pits were not visible from the ground surface.

## U.S. EPA SURVEY

The only landfill activities observed during the U.S. EPA photograph analysis were a fill area and a trench running parallel to Perimeter Road on the 1965 photograph. The area was graded and revegetated by 1970. The 1980 photograph shows a large area of disturbed ground near the southwestern portion of the landfill. On the same photo, disturbed ground and an impoundment with liquid were identified northwest of the landfill; the areas reportedly were revegetated by 1981. The impoundment, however, was still visible in 1981, and appeared as a depression in 1989. Another possible impoundment in the same area appeared in 1986, and a dark rectangular area is seen on the 1991 photograph (Jacobs Engineering 1993a).

Because there are no indications that the area of disturbed ground in the southwestern portion of the landfill or that the impoundments in the northwestern area are related to landfilling activities, they were not included in Site 5. The Phase I RI Sampling and Analysis Plan Amendment defined Site 5 as the trenched area that is indicated by the photographs and the geophysical survey (Jacobs Engineering 1993a).

## SCIENCE APPLICATIONS INTERNATIONAL CORPORATION SURVEY

The SAIC aerial photo assessment identified the former landfill on the 1967 photograph as a backfilled trench. A probable small backfilled trench with east-west orientation and an area of disturbed ground were located north of the landfill. However, because of the poor resolution and the small scale of the aerial photograph (1:32000), it is difficult to positively identify these features. In 1975, an impoundment, disturbed ground, and an excavation were noted "near the intersection of Perimeter Road and Magazine Road." The exact location of these features is unclear, because the 1975 photograph was not reproduced for the report (SAIC 1993). Another area of disturbed ground, covering the location of the smaller landfill, was observed on the 1979 photograph. The impoundment with liquid mentioned by U.S. EPA was visible in 1984. Southwest of Perimeter Road Landfill, a large impoundment area and fill area were seen on the 1979 photograph. The impoundments are surrounded by berms and contain open trenches. The fill area seems to be a construction site (Jacobs Engineering 1993a).

Because the landfill operated from about 1955 to the late 1960s, the features analyzed on the SAIC photographs and described above are not related to Site 5.

## AIR SWAT

The following activities were conducted as part of the Air SWAT (Strata 1991):

- landfill gas sampling,
- ambient air sampling,
- integrated surface sampling, and
- landfill gas migration testing.

A summary of the Air SWAT analytical results is presented below. The Air SWAT report did not quantify compound detection limits. If the compound was not detected, it was reported as nondetect (ND).

### *Landfill gas*

- VOCs: dichloromethane (110 to 290 parts per billion by volume [$ppb_v$]) trichloroethylene (ND to 2,700 $ppb_v$), tetrachloroethene (ND to 71 $ppb_v$) and,
- other gases: hydrogen (ND to 0.35 percent by volume [$\%_v$]), oxygen (13 to 20 $\%_v$), nitrogen (79 to 80 $\%_v$) and, carbon dioxide (0.72 to 6.9 $\%_v$).

### *Ambient Air*

- VOCs: dichloromethane (3.3 to 13 $ppb_v$), 1,1,1-trichloroethane (0.55 to 2.8 $ppb_v$), tetrachloroethene (ND to 0.38 $ppb_v$)

### *Integrated Surface Sampling*

- total organic compounds (TOCs) as methane (< 2 parts per million by volume [$ppm_v$])

### *Landfill Gas Migration Sample Points*

- TOCs (< 1 $ppm_v$)

## Geology

Site 5 lies along Perimeter Road on the edge of a grassy field at an elevation of about 430 feet mean sea level. The landfill is covered with a layer of imported fill of unknown thickness and is relatively flat. The surface of the site is overgrown with weeds. Based on a review of Phase I RI boring logs, subsurface soil consists of discontinuous lenses of clay, silt, sandy silt, and sand (Jacobs Engineering 1993b). Materials encountered in the northern part of the landfill were mostly sand with some thin clay layers. At the southern end of the site, semiconsolidated to consolidated material was encountered at a depth of about 200 feet bgs. Subsurface soil becomes increasingly clayey toward the southern end of the site.

## Hydrogeology

Groundwater lies at a depth of about 190 feet bgs and follows a regional gradient to the west northwest (Jacobs Engineering 1993b, 1994b). The potential for surface water runoff appears to be slight.

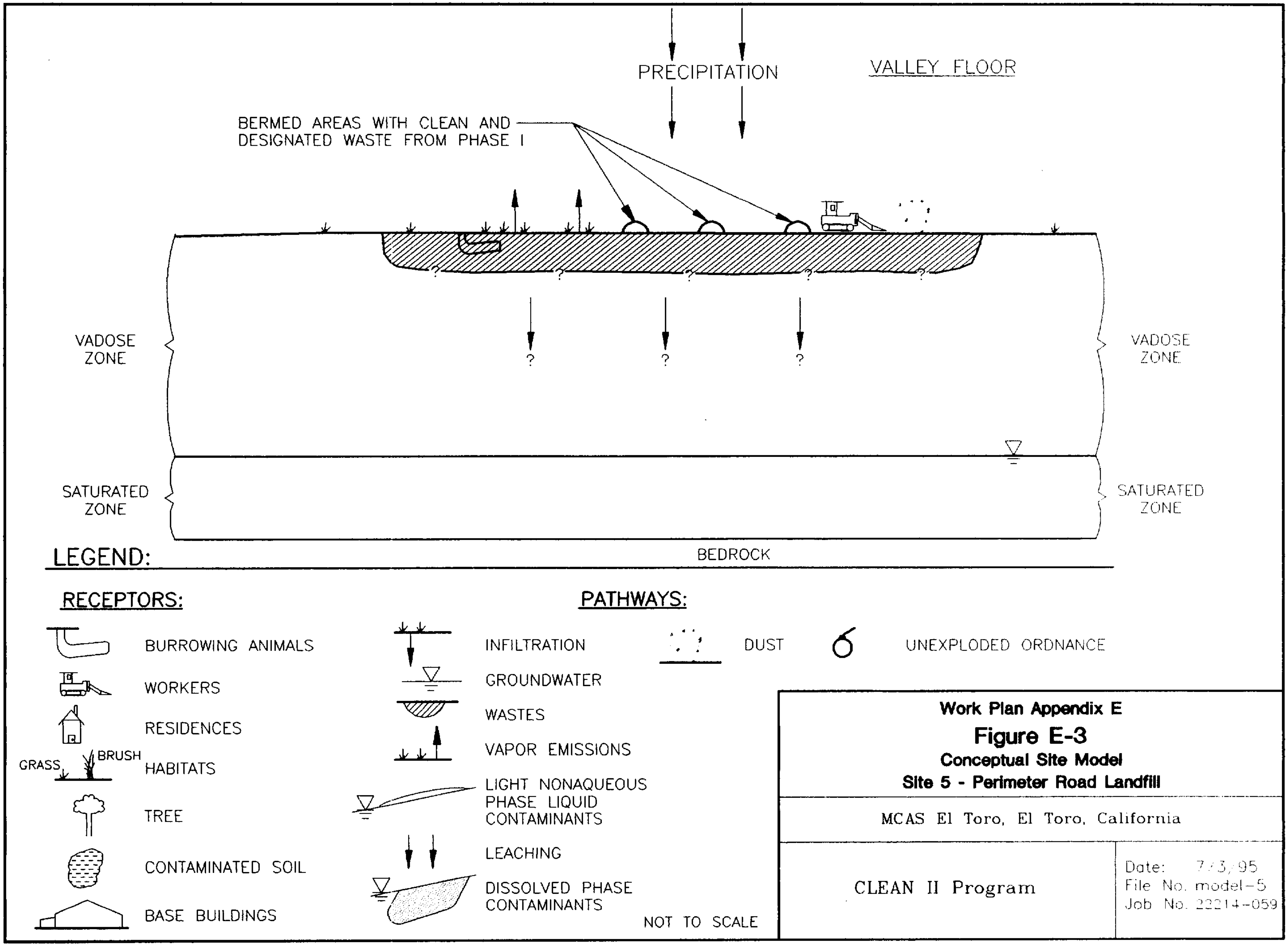
## Conceptual Site Model

Figure E-3 shows the conceptual site model for Site 5, and Figure E-4 shows the potential exposure routes and pathways for human receptors.

The primary release mechanism is the surficial release of contaminants to shallow soil resulting from historic waste disposal activities at this site. Eventually under gravity, contaminants present in shallow soil may move downward with soil moisture (in dissolved phase) or in a liquid phase. Because this site contains a variety of wastes, the wastes potential mobility in the environment is could be significant. The depth of groundwater is recorded to be about 100 to 150 feet bgs.

The secondary source of contaminants is the surrounding soil impacted by disposal activities. The secondary release mechanism is the dust brought into suspension in the air. The fine particles of dust may contain all potential contaminants.

The potential pathways are air and groundwater. Airborne contaminants are transported through fugitive dust and volatilization. The transport through air is affected by wind speed and direction, type of contaminant, and weather conditions. Typical wind condition at MCAS E1 Toro is from west/southwest at less than 10 knots. Transportation of airborne contaminants through volatilization is expected to be largely unimportant at this site.




**Work Plan Appendix E**

**Figure E-3**

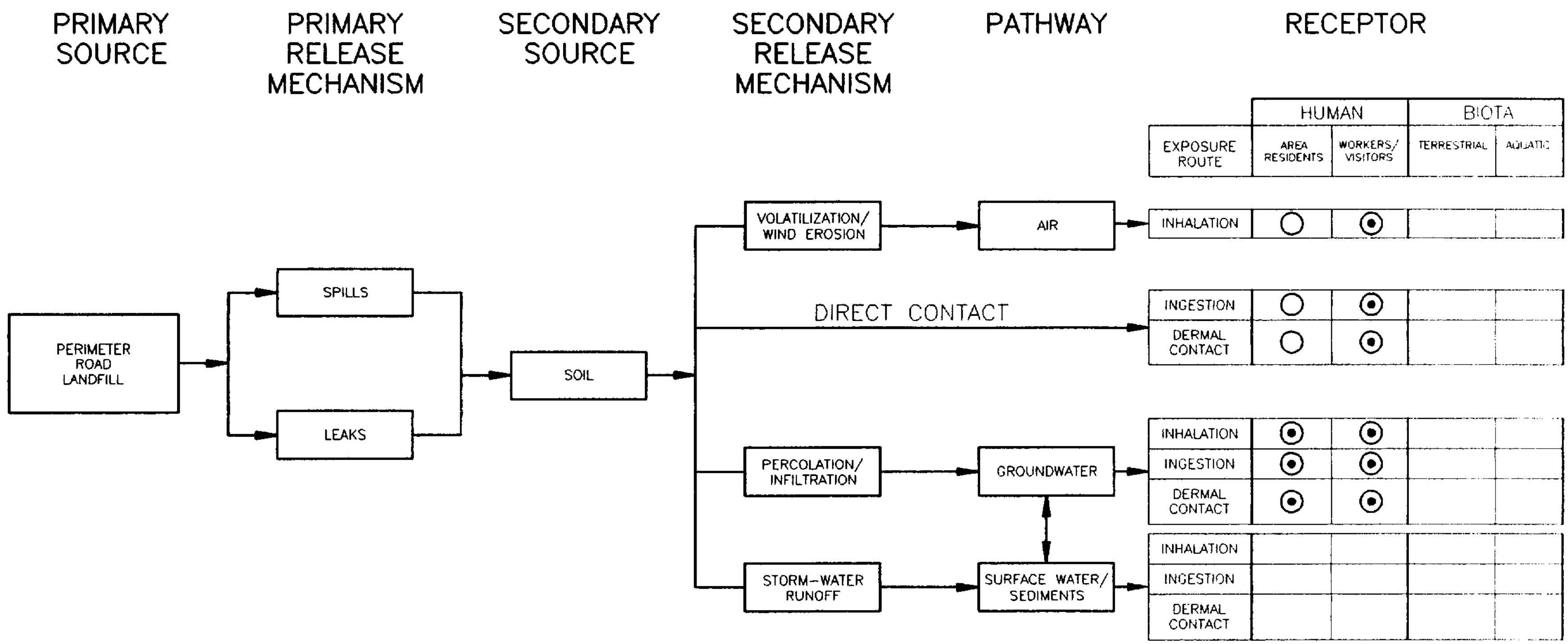
**Conceptual Site Model**

**Site 5 - Perimeter Road Landfill**

MCAS El Toro, El Toro, California

CLEAN II Program

Date: 7/3/95
File No. model-5
Job No. 22214-059




LEGEND:

● CURRENT POTENTIAL RECEPTOR

○ FUTURE POTENTIAL RECEPTOR

**Work Plan Appendix E**

**Figure E-4**

**Exposure Routes and Receptors**
**Site 5 - Perimeter Road Landfill**

**MCAS El Toro, California**

CLEAN II Program

Date: 6/28/95
File No. mod5
Job No. 22214-059

Current and/or potential receptors of chemicals at this site are workers and visitors involved in disposal activities. Direct contact with surface and subsurface soils is currently possible via dermal or ingestion exposures to workers. Infiltration of contaminated water through the vadose zone into groundwater is possible because subsurface soil is mainly sands, with some silts and clays. However, current exposure of workers is unlikely via ingestion of groundwater at this site.

Terrestrial wildlife could be exposed to chemicals in on-site surface soil and to dust and vapors through ingestion, dermal absorption, or inhalation. Terrestrial plants could also be exposed through root absorption of chemicals in surface soil or deposition of dusts. However, no ecological receptors or potential habitats other than grassland have been identified at this site.

### Statement of Phase II RI Problem

Employee interviews suggest that the extent of landfilled solid waste has not been fully defined. Antimony, arsenic, nitrate, and gross alpha and beta particle activity in groundwater exceeds human health PRGs and/or federal drinking water MCLs. TCE, PCE, and benzene have been detected in groundwater, but below PRGs and MCLs. The potential contribution from landfill leakage to the groundwater problem has not been fully assessed. The downgradient extent of chemicals of potential concern (COPCs) in groundwater has not been delineated.

## STEP 2 – IDENTIFY THE DECISION

This step describes the decisions that will be considered during the DQO process for Site 5. For each decision, alternative outcomes that could result from the resolution of that decision are also stated. A decision logic diagram is included as Figure E-5. For Site 5, the Perimeter Road Landfill, the following decisions are considered:

1. Are solid wastes exposed?

   If yes, evaluate response actions.

   If no, evaluate other response action requirements.

2. Have the limits of landfilled wastes been defined?

   If yes, recommend no further investigation to define limits of landfill waste.

   If no, define the limits of disposed waste using surface geophysical survey and trenching, if necessary.

3. Are the action levels for ambient air exceeded?

   If yes, evaluate response actions.

   If uncertain, collect and analyze ambient air samples.

   If no, recommend no further action for ambient air.

4. Are hot spots present within the landfills?

   If yes:

   a) does evidence exist to indicate the presence and approximate location of wastes?

   b) is the hot spot known to be principal threat waste?

   c) is the waste in a discrete, accessible part of the landfill?

   d) is the hot spot known to be significant enough that its remediation will reduce the threat posed overall by the landfill, but small enough to be economically removable?

   If yes to the four proceeding questions, then evaluate treatment and removal actions.

   If no to any of the above, then recommend no further action for hot spots; however, the landfill may still require further remedial action.

5. Do data indicate that leakage from the landfill has impacted groundwater?

   If yes, characterize the nature and extent of COPCs in groundwater.

   If no, recommend no further action for groundwater.

   If uncertain, install monitoring wells and collect groundwater samples at the perimeter of the landfill.

6. Do data indicate that leakage from the landfill has impacted the subsurface soil?

   If yes, vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.

   If no, recommend no further action for the subsurface soils.

   If uncertain, monitor vadose zone for indications of leakage.

7. Has the nature and vertical extent of COPCs in groundwater been defined?

   If yes, recommend no further investigation for groundwater.

   If no, define the nature and extent of COPCs in groundwater.

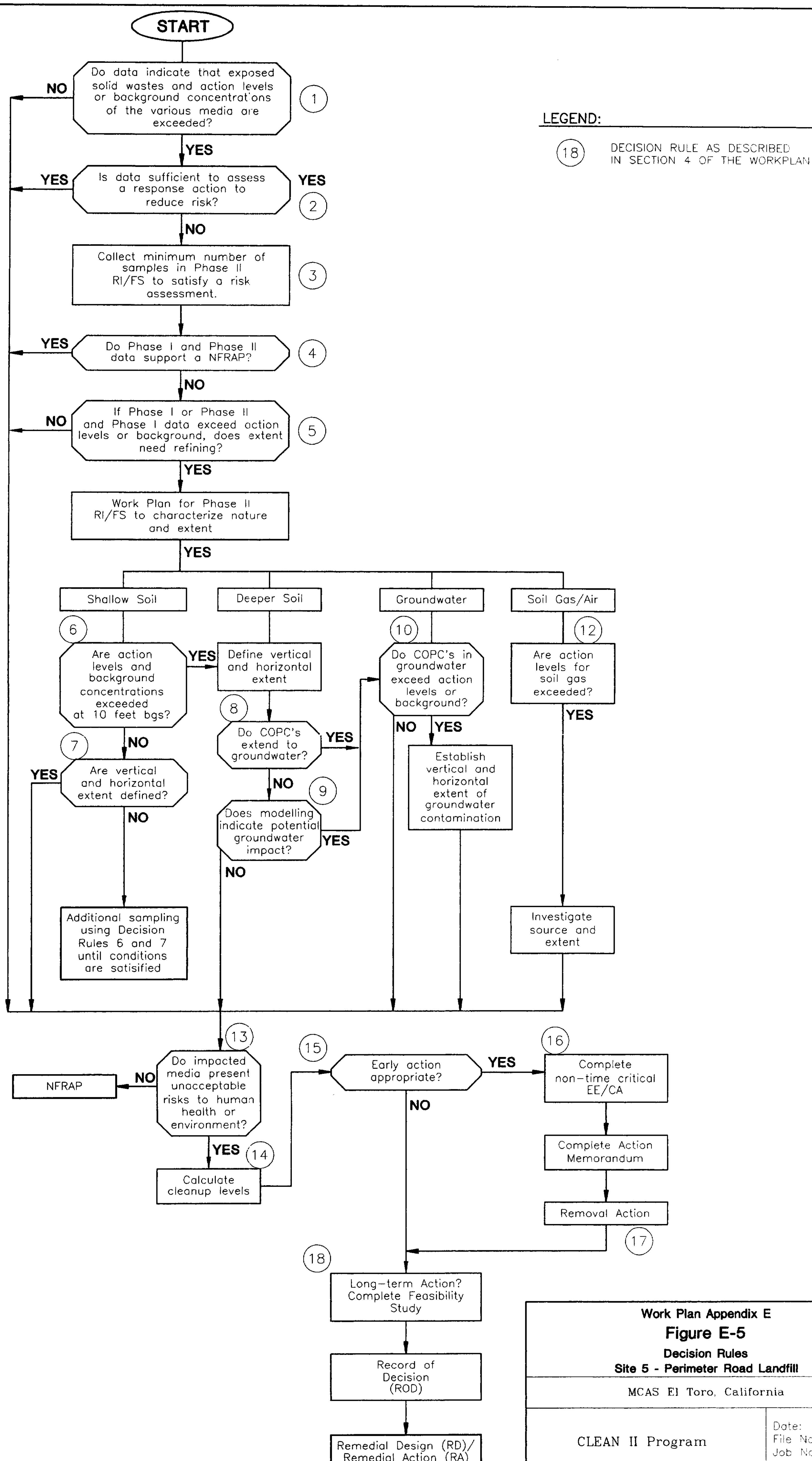
8. Based on existing data, is the stockpiled IDW soil sufficiently characterized to evaluate treatment or disposal options?

   If yes, evaluate disposal options.

   If no, collect necessary data to evaluate treatment or disposal options.

## STEP 3 – IDENTIFY THE INPUT AFFECTING THE DECISION

Step 2 defined the decisions addressing possible response actions at the site. Step 3 will identify inputs that are required to assess the possible actions.




**Work Plan Appendix E**

**Figure E-5**

**Decision Rules**

**Site 5 - Perimeter Road Landfill**

MCAS El Toro, California

CLEAN II Program

Date: 7/19/95
File No. flow-5
Job No. 22214-059

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## Inputs for No Further Response Action Planned

For landfill units, inputs for no further response action include performing an air emission survey of the landfill and monitoring the vadose zone and groundwater for the presence of possible contaminants. Consequently, Phase II RI data collection should include verifying (where appropriate) Phase I RI air emission data through limited air emission sampling, monitoring upgradient and downgradient groundwater quality by installing and sampling wells, sampling subsurface soils for landfill gas, and monitoring the vadose zone beneath the landfill using gas probes installed with slant-drilling techniques.

Input information required to support a No Further Response Action Planned decision will also be used to support decisions for early action and long-term action. These inputs are listed below:

- nature and concentrations of surface emitted gas (e.g., $CO_2$, $H_2S$, $CH_4$, and VOCs);
- definition of the nature and extent of COPCs in groundwater;
- nature and extent of landfill gases (e.g., $CO_2$, $H_2S$, $CH_4$, and VOCs);
- assessment of potential landfill leakage using soil gas and leachate sampling techniques;
- assessment of risk for the site; and
- action levels for protection of human health and the environment.

## Inputs for Early Action

An Early Action at a landfill may consist of a presumptive remedy. Several presumptive remedies are recognized by U.S. EPA for Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) municipal landfill sites. The Perimeter Road Landfill can be classified as a municipal landfill because the wastes present are a large-volume, heterogeneous mixture of municipal (e.g., nontoxic household, construction, and landscaping debris), industrial, and limited hazardous wastes (including fuel hydrocarbons, solvents, pesticides, and metals). The presumptive remedy approach allows for unit closure after resolving hot spot issues and taking engineered or institutional steps to limit the release of contaminants to the environment (U.S. EPA 1993b).

Under presumptive remedy approach, engineered designs are prepared to limit the release of contaminants to the atmosphere, surface water, and groundwater. In general, the designs may include the following:

- capping the landfill to limit direct contact with disposed waste, infiltration and resulting contaminant leaching to groundwater, and surface water runoff and erosion;
- any necessary groundwater treatment to reduce the impact of released contaminants; and

- any necessary gas control and treatment to reduce uncontrolled atmospheric releases and the mass of subsurface volatile contaminants.

Under the presumptive remedy, institutional controls are implemented to limit exposure to landfilled waste. The most common control is a deed restriction. Related Phase II data collection activities should thus include the delineation of landfill boundaries to allow the preparation of legal descriptions for the deed restrictions.

Additional input information supporting presumptive remedy decisions include the following:

- location, nature and extent of potential hot spots;
- existence, areal extent, depth, nature, and condition of landfill cap; and
- delineation of landfilled wastes using historic, nonintrusive (e.g., electromagnetic), or intrusive (e.g., trenching) techniques.

## Inputs for Long-Term Action

Additional input information supporting Long-Term Action decisions include the following:

- nature and extent of COPCs in subsurface soil, characteristics of soil (e.g., gas permeability);
- typical, low, and high flow rates for surface water drainages, estimated infiltration rates, proximity to landfilled wastes;
- aquifer characteristics; and
- topography of site.

## Descriptions of Inputs

The following subsections provide a brief discussion of the inputs to assess possible response actions.

### CHEMICALS OF POTENTIAL CONCERN

COPCs for Site 5 include all chemicals detected in the Phase I RI for each medium and area of investigation, with the exception of metals in shallow (0 to 10 feet bgs) soil. Metals with concentrations in shallow soil that exceed background/ambient concentrations are included as COPCs and are listed (by chemical name) below.

#### *Shallow Soil (0 to 10 feet below ground surface)*

- metals: lead;
- VOC: toluene;
- herbicides: 2,4,5-trichlorophenoxypropionic acid (Silvex);

- pesticides and PCBs: 4,4'-DDT, methoxychlor; and
- fuel and petroleum hydrocarbons: TFH-gasoline, TRPH.

### *Subsurface Soil (> 10 feet below ground surface)*

- metals: 20 of 23 TAL metals;
- SVOCs: bis(2-ethylhexyl) phthalate;
- herbicides: MCPP; and
- fuel and petroleum hydrocarbons: TFH-diesel, TRPH.

### *Groundwater – Upgradient (05_UGMW27)*

- general chemistry: bicarbonate, chloride, nitrate/nitrite as N, sulfate, total dissolved solids (TDS);
- metals: 10 of 23 TAL metals; and
- VOC: tetrachloroethene, TCE.

### *Groundwater – On-Site (05_DBMW41)*

- general chemistry: bicarbonate, chloride, nitrate/nitrite as N, sulfate, TDS;
- metals: 10 of 23 TAL metals;
- VOCs: tetrachloroethene, chloromethane (methyl chloride); and
- gross alpha and beta: gross alpha, gross beta.

### *Groundwater – Downgradient (05_DGMW67, 05_DGMW68)*

- general chemistry: bicarbonate, chloride, nitrate/nitrite as N, sulfate, TDS;
- metals: 16 of 23 TAL metals;
- VOC: benzene, chloromethane (methyl chloride); and
- gross alpha and beta: gross alpha, gross beta.

## NATURE AND EXTENT OF CONTAMINATION

Phase II RI/FS sample locations and analyses have been selected so Phase I and II RI/FS data can be evaluated to assess risks associated with the landfill. If further definition of extent of impacted media is necessary, then further sampling will be conducted.

## BACKGROUND AMBIENT CONCENTRATIONS

Background ambient concentrations are presented in Section 4 of the Work Plan.

### DETERMINATION OF RISK

A determination of the human health risk associated with each site is based on a baseline or streamline risk assessment. Baseline risk assessments are performed on RI/FS sites. The objective of a baseline risk assessment is to estimate the risks associated with the no action alternative and thereby provide decision makers information useful in identifying the most appropriate remedial action alternative. The risk estimates produced also serve as a benchmark to which reductions in risk achieved by remedial actions may be compared. Streamlined risk assessments are performed on removal action sites to support the removal action.

In addition to the human health risk assessment conducted for a site, an ecological risk assessment may also be performed. The ecological risk assessment will evaluate current and potential risks to the environment posed by the chemical releases that have occurred at the sites.

### IDENTIFICATION OF CLEANUP LEVELS

Cleanup levels will be based on applicable or relevant and appropriate requirements, background/ambient concentrations and risk levels to be determined for the site.

### TECHNOLOGY EFFECTIVENESS, IMPLEMENTABILITY, AND COST

Once cleanup standards have been established, the most appropriate and cost-effective approach will be identified to remediate the site/unit, if necessary.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

This step defines the spatial and temporal boundaries of the problem and any practical constraints that may interfere with the study. The boundaries of the study reflect the results of the ground-penetrating radar survey performed during the Air SWAT investigation, the electromagnetic (EM) conductivity survey performed during the Phase I RI, the U.S. EPA analysis of historical aerial photographs, and results of the employee interviews. The sites boundaries also encompass areas of site activity (debris, trenching, liquid, mounded material, and stains identified on historical aerial photographs) that lay outside the landfill boundaries. A site plan is included as Figure E-2.

The site has been subdivided into study units which represent areas of generally similar geologic media or surface features. For Site 5 the study units are:

- Unit 1: area occupied by the landfill; and
- Unit 2: Phase I RI stockpiled IDW soil.

Phase II RI activities will be organized using the unit subdivisions listed above.

# STEP 5 – DEVELOP DECISION RULES

Decision rules are required to state explicitly the types of inputs and logical basis for choosing among alternative actions during the Phase II RI/ FS. The following decision rules apply to Site 5 and numbers correspond with Step 4 of the Work Plan.

3. If Phase I data are not sufficient to assess whether risks are present based on the minimum number of samples, then Tier 1 sampling of the Phase II RI/FS will be completed to supplement the Phase I analytical results so the minimum number of samples is satisfied to assess whether action levels or background/ambient concentrations are exceeded in site units.

5. If Phase I data or Tier 1 data of the Phase II RI/FS combined with Phase I data exceed PRGs, action levels, or background/ambient concentrations for the various media, then Tier 2 of the Phase II RI/FS sampling and analyses will be conducted to define horizontal and vertical extent, provided additional sampling costs are not more than a potential response action.

6. If PRGs, action levels, or background/ambient concentrations for shallow soil are exceeded, and if COPCs detected in the soil extend to 10 feet bgs, then soil below 10 feet bgs (subsurface soil) will be investigated to assess the horizontal and vertical extent of the COPCs.

7. If during the investigation of COPCs in subsurface soil, two consecutive soil sample analyses (at a minimum 5-foot-depth separation) demonstrate that COPCs are not detected, then the vertical extent of soil contamination will be established and investigation of subsurface soil will be halted at that location. The horizontal extent will be established when COPCs are not detected in vertical samples taken at three locations around the sample that exceeds the action levels.

   The lowest detection limit available will be used to define the base of a contaminant plume. COPC detection or quantitation limits that will be compared to establish the base of the contaminant plume include the following:

   - contract-required detection limit,
   - contract-required quantitation limit,
   - sample quantitation limit,
   - estimated quantitation limit,
   - practical quantitation limit,
   - method detection limit, and
   - instrument detection limit.

9. If COPCs are identified in subsurface soil below 10 feet bgs, above background/ambient and action levels, but do not extend to the water table, then

vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.

10. If it is determined that COPCs in subsurface soil have impacted groundwater causing exceedance of action levels, then the vertical and horizontal extent of groundwater exceedance will be evaluated.

11. If action levels or background/ambient concentrations for surface water or sediment are exceeded, then potential sources (these will likely be nonpoint sources) will be investigated.

12. If action levels for air are exceeded, which are specified in South Coast Air Quality Management District (SCAQMD) Rule 1150.1 and 40 *Code of Federal Regulations* (CFR) Parts 258.23, then potential sources and extent will be investigated.

13. If action levels or background/ambient concentrations are exceeded for the media of a site unit, then the risk assessment will be initiated, based on sample results, acceptable levels of risk, and potential land uses, to assess potential risks to human health and/or the environment.

14. If unacceptable risks are assessed to human health or the environment, then cleanup levels will be evaluated for each media.

15. If cleanup levels in a given medium are exceeded, and if the site meets at least one of the eight criteria for removal action described in 40 CFR 300.415(b)(2), and the scale and complexity of contaminant distribution in the affected medium are such that excess risk can be expediently reduced utilizing readily available technology, then the medium at the site will be recommended for Early Action.

16. If a Non-Time-Critical Removal Action is selected, an Engineering Evaluation/Cost Analysis and Action Memorandum will be completed for the removal action.

17. Once the removal action is completed, the site will be evaluated for residual risk. If a residual risk exists, then a Long-Term Action may be required.

18. If cleanup levels for a given medium are exceeded, and if the site does not meet criteria for an Early Action, then the affected medium will be recommended for long-term remedial action as part of the RI/FS process; and an FS will be completed, followed by a Record of Decision, Remedial Design (RD), and Remedial Action to clean up the site for closure.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

Two types of sampling designs are used to determine the soil conditions at Site 5. These two sampling designs are:

- areal systematic random sampling (grid); and
- judgmental sampling.

The grid sampling design utilizes the random positioning to produce a random, unbiased sampling design. Using an unbiased sampling design, the tolerance limits for false-positive and false-negative decision errors can be applied to the sample data. Further, statistical methodology can be used to evaluate the sample analytical results against the designated action levels for this project. This provides a basis for assigning a level of confidence to the risk decisions.

The soil gas survey sampling design proposed for Site 5 is areal systematic random sampling. An areal systematic random sampling design is used to characterize the nature and extent of a problem and detect hot spots. The initial round of sampling will be on a 200-foot grid spacing, providing an 80-percent confidence of hitting a circular hot spot having a radius of 100 feet (Gilbert 1987). If after the first round of soil gas sampling and potential hot spots have been identified, then a second round of sampling will be performed on a 25-foot interval grid. The 25-foot grid spacing provides a 80-percent confidence of hitting a circular hot spot with a radius of 12.5 feet (Gilbert 1987).

Judgmental sampling is a special design that is not performed to address general issues such as risk. Rather, judgmental sampling is designed to provide answers to a more specific questions or issues. As such, the confidence and power limits associated with statistically based sampling designs do not apply here. Decision errors will be considered, but they cannot be evaluated statistically. This makes careful application of field and laboratory techniques important because corroborating data from multiple samples will not necessarily be available. Air, groundwater, and vadose zone sample locations are judgmental. The exact sample locations will be made in the field based on available data and regulatory guidelines.

## STEP 7 – OPTIMIZE THE DESIGN

This step in the DQO process is used to identify the most resource-effective sampling and analytical design for generating data that are expected to satisfy the DQO.

The following site units have been defined for Site 5:

- Unit 1: area occupied by the landfill; and
- Unit 2: Phase I RI stockpiled IDW soil.

The sampling program will be implemented by following a tiered approach. At the conclusion of each tier, collected data will be evaluated, and based on the results of the evaluation, decisions will be made whether or how to proceed with additional field activities outlined in subsequent tiers.

- Tier 1 activities includes collecting additional samples to assess whether the site is a risk and includes nonintrusive investigations, limited intrusive sampling (e.g., soil gas surveys), and the sampling of existing systems (e.g., wells);
- Tier 2 activities include more extensive intrusive investigations to evaluate the horizontal and vertical extent of impacted media; and

- Tier 3 activities include RD-oriented activities such as soil vapor extraction or aquifer tests.

Analytical tests to be performed for each media type and tier are summarized on Tables E-1 through E-4.

## Unit 1: Landfill Area – Define Limits of Landfilled Wastes

Two key components of the U.S. EPA presumptive remedy for municipal landfills include the use of a landfill cap and institutional controls (e.g., deed restrictions) to reduce surface and subsurface releases of contaminants. The purpose of Tier 1 of the Phase II RI is to help define the extent of landfilled wastes to:

- allow an estimate of the areal size of the cap, and
- develop legal descriptions of the landfill area for inclusion in deed restrictions.

To better define the limits of landfilled wastes, the following activities will be performed during the Tier 1 investigation:

- use of existing information (e.g., geophysics data, historical aerial photographs, and employee interviews) to tentatively define limits of landfilled wastes; and
- confirm or modify the tentative limits with the use of EM geophysical techniques.

At the conclusion of Tier 1 activities, the following Tier 2 activity will be performed, as necessary: confirm EM data interpretation by performing limited trenching to locate the boundary of landfilled wastes.

At Unit 1, the EM surface geophysical survey will be performed on a layout consisting of lines spaced at 50 feet; trenching will occur at locations selected after a review of results from the EM surveys.

## Unit 1: Landfill Area – Evaluate Site for Hot Spots

The U.S. EPA presumptive remedy for municipal landfills includes a step that addresses hot spots within landfills. "Hot spots" are defined as discrete, accessible portions of the landfill that contain principal threat wastes, such as chlorinated solvents. The definition implies that the hot spot has chemical characteristics and volume such that the integrity of the presumptive remedy (i.e., containment of wastes through capping) is not threatened if the hot spot is left in place.

To evaluate the presence of hot spots within the landfill unit the following activities will be performed as part of Unit 1, Tier 1 tasks.

- The first soil gas sampling location will be selected independently and randomly. The remaining points will be selected from a 200-foot, on-center grid from that original location. Samples will be collected from a depth of approximately 15 feet. Samples will be analyzed using an on-site mobile laboratory. Soil gas samples will be analyzed in accordance with procedures and analytical methods outlined in the California RWQCB "Requirement for Active Soil Gas Investigations" (modified to

# Table E-1
## Soil Sampling and Analysis – On-Site Mobile Laboratory

| | | | | | ON-SITE MOBILE LABORATORY | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Tier | Unit/Name | No. of Locations | Samples/ Location[a] | Total Samples | VOCs[b] | SVOCs[c] | TPH[d] | Metals | Gross Alpha & Beta[e] |
| Tier 1 | Landfill Area | NA[f] | | | | | | | |
| | Stockpiled IDW[g] Soil | NFI[h] | | | | | | | |
| Tier 2 | Landfill Area | 3 | 1 or 5[i] | 7 | 7 | 7 | 7 | 7 | 7 |
| | Stockpiled IDW Soil | NFI | | | | | | | |
| | *Total* | | | 7 | 7 | 7 | 7 | 7 | 7 |

Notes:

[a] A minimum of one soil sample from each slant boring drilled in the vadose zone and five soil samples from each groundwater monitoring well. Groundwater monitoring well will be sent to the on-site mobile laboratory.
[b] VOC – volatile organic compound
[c] SVOC – semivolatile organic compound
[d] TPH – total petroleum hydrocarbons
[e] saturated soil sample
[f] NA — not applicable
[g] IDW – investigation-derived waste
[h] NFI — No Further Investigation
[i] One soil sample will be collected from each slant boring drilled in the vadose zone and five samples will be collected from each groundwater monitoring well.

**Table E-2**
**Soil Sampling and Analysis – Off-Site Laboratory**

| | | | | | OFF-SITE LABORATORY[a] | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tier | Unit/Name | No. of Locations | Samples/ Location[b] | Total Samples | VOCs[c] | SVOCs[d] | TPH[e] | Pesticides/ PCBs[f] | Herbicides | Total Organic Carbon[g] | Metals | Gross Alpha & Beta |
| Tier 1 | Landfill Area | NA[h] | | | | | | | | | | |
| | Stockpiled IDW[i] Soil | NFI[j] | | | | | | | | | | |
| Tier 2 | Landfill Area | 3 | 1 or 5[k] | 7 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |
| | Stockpiled IDW Soil | NFI | | | | | | | | | | |
| *Total* | | | | 7 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 2 |

Notes:
[a] A minimum of 20 percent of the total samples sent to the on-site mobile laboratory will be sent to an off-site laboratory for QA/QC.
[b] A minimum of one soil sample from each slant boring drilled in the vadose zone and five soil samples from each groundwater monitoring well. Groundwater monitoring well will be sent to the on-site mobile laboratory.
[c] VOC – volatile organic compound
[d] SVOC – semivolatile organic compound
[e] TPH – total petroleum hydrocarbons
[f] PCB – polychlorinated biphenyl
[g] saturated soil sample
[h] NA — not applicable
[i] IDW – investigation-derived waste
[j] NFI — No Further Investigation
[k] one soil sample will be collected from each slant boring drilled in the vadose zone and five samples will be collected from each groundwater monitoring well.

## Table E-3
## Soil Gas Sampling and Analysis

| Tier | Unit/Name | No. of Locations | Samples/ Location[a] | Total Samples | ON-SITE MOBILE LABORATORY[b] TO-14 (Methane) | OFF-SITE LABORATORY[c] TO-14 (Methane) |
|---|---|---|---|---|---|---|
| Tier 1 | Landfill Area | 22[d]+TBD[e] | 1 or 3 | 36 | X | X |
| | Stockpiled IDW[f] Soil | NA[g] | | | | |
| Tier 2 | Landfill Area | 2 | 1 | 2 & TBD | X | X |
| | Stockpiled IDW Soil | NA | | | | |
| *Total* | | | | 38 & TBD | 2 | 1 |

Notes:
[a] Samples will be collected from 15 locations on the landfill at depths of 15 feet. Samples will be collected from 7 locations outside the landfill boundary at depths of 10, 25, and 40 feet bgs. A minimum of one sample will be collected from each slant boring drilled in the vadose zone.
[b] All soil gas samples collected will be sent to the on-site mobile laboratory for analysis.
[c] A minimum of 10 percent of the samples sent to the on-site mobile laboratory will be sent to an off-site laboratory for QA/QC.
[d] Additional soil gas samples may be collected to better define hot spots within the landfill.
[e] TBD – to be determined
[f] IDW – investigation-derived waste
[g] NA – not applicable; included in landfill area samples

## Table E-4
## Groundwater Sampling and Analysis

| | | | | | Off-Site Laboratory | | | | | | | | On-Site Mobile Laboratory |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Tier** | **Unit/Name** | **No. of Locations** | **Samples/ Location** | **Total Samples** | **VOCs[a]** | **SVOCs[b]** | **TPH[c]** | **Pesticides/ PCBs[d]** | **Herbicides** | **General Chemistry** | **Metals** | **Gross Alpha & Beta** | **VOCs** |
| Tier 1 | Landfill Area | NA[e] | | | | | | | | | | | |
| | Stockpiled IDW Soil | NA | | | | | | | | | | | |
| Tier 2 | Landfill Area | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |
| | Stockpiled IDW Soil | NA | | | | | | | | | | | |
| | *Total* | | | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

Notes:
[a] VOC – volatile organic compound
[b] SVOC – semivolatile organic compound
[c] TPH – total petroleum hydrocarbons
[d] PCB – polychlorinated biphenyl
[e] NA – not applicable

- include methane) (RWQCB 1994). Laboratory test results will be used to identify potential soil gas hot spots.
- Potential hot spots (i.e., > 300 µg/L), identified by the 200-foot grid for sampling, will be further characterized using a 25-foot grid. A value of 300 µg/L was selected based on the isoconcentration lines presented in the Final Soil Gas Survey (Jacobs Engineering 1994c). This value will be reevaluated after the data from the 200-foot grid survey are assessed in their entirety.

At the conclusion of Tier 1 activities, the following Tier 2 activity will be performed as necessary: If a significant, localized source of landfilled waste gases is found, a drill rig may be used to advance a borehole(s) to further investigate the nature and extent of the source. This will be accomplished through subsurface sampling and analysis of samples for VOCs, SVOCs, metals, and pesticides.

The location of soil gas grid sampling points are shown on Figure E-2.

## Unit 1: Landfill Area – Assess Air Emissions

An Air SWAT has been performed at the MCAS El Toro landfill sites to estimate landfill gas emission to the atmosphere and to assess potential health risks to human receptors. The current Air SWAT data are questionable, since they suggest contamination during field or laboratory handling (Strata 1991). Consequently, additional landfill gas emission data are required.

Air monitoring and sampling will be performed to reassess the migration of landfill gas into the atmosphere by verifying and supplementing existing emission data. The resulting data will be used to verify the effectiveness of the existing cap; determine if additional control of landfill gas emission is necessary; and support the streamlined risk assessment. Air samples will be analyzed for landfill gases and VOCs using U.S. EPA Method TO-14. Air sampling will be performed to satisfy SCAQMD Rule 1150.2 requirements for the control of gaseous emissions from inactive landfills (SCAQMD 1989). The sampling program consists of an instantaneous gas sampling survey, integrated surface gas sampling, flux chamber monitoring, ambient air sampling, landfill gas migration, and collection of local meteorological data. Meteorological data will be used to identify the optimum number and locations of the ambient air samples.

To assess gaseous emissions from the landfill unit the following activities will be performed as part of Unit 1, Tier 1 tasks.

- Instantaneous Gas Sampling – SCAQMD Rule 1150.2 requires an instantaneous gas emissions survey as a screening process to identify potential location of high emission concentrations, where total organic compounds emissions, measured as methane, exceeds 500 $ppm_v$ at any point of the landfill surface. The instantaneous sampling survey consists of a sampling grid where the concentration of the gas immediately above the surface of the landfill is monitored with a portable flame-ionization detector.

- Integrated Surface Samples – SCAQMD Rule 1150.2 requires integrated surface samples be collected to assure that the average concentration of TOCs over a certain area (50,000 square feet) does not exceed 50 $ppm_v$.
- Flux Chamber Monitoring – For human health and ecological risk assessment purposes, but not required by SCAQMD Rule 1150.2, landfill gas emissions will be collected from an isolated soil surface area using an emission isolation flux chamber. The location and number of flux chamber samples will be determined after the review of the surface emission and soil gas sampling results.
- Ambient Air Sampling – Ambient air sampling will be performed at the perimeter of Site 5 to evaluate the potential for off-site atmospheric impacts associated with landfill gas emissions.
- Landfill Gas Migration – Lateral migration of landfill gas will be evaluated during the soil gas survey by collecting samples at not less than 1,000 feet spacing outside the fill areas and along the perimeter of the site from approximate depths of 10, 25, and 40 feet.

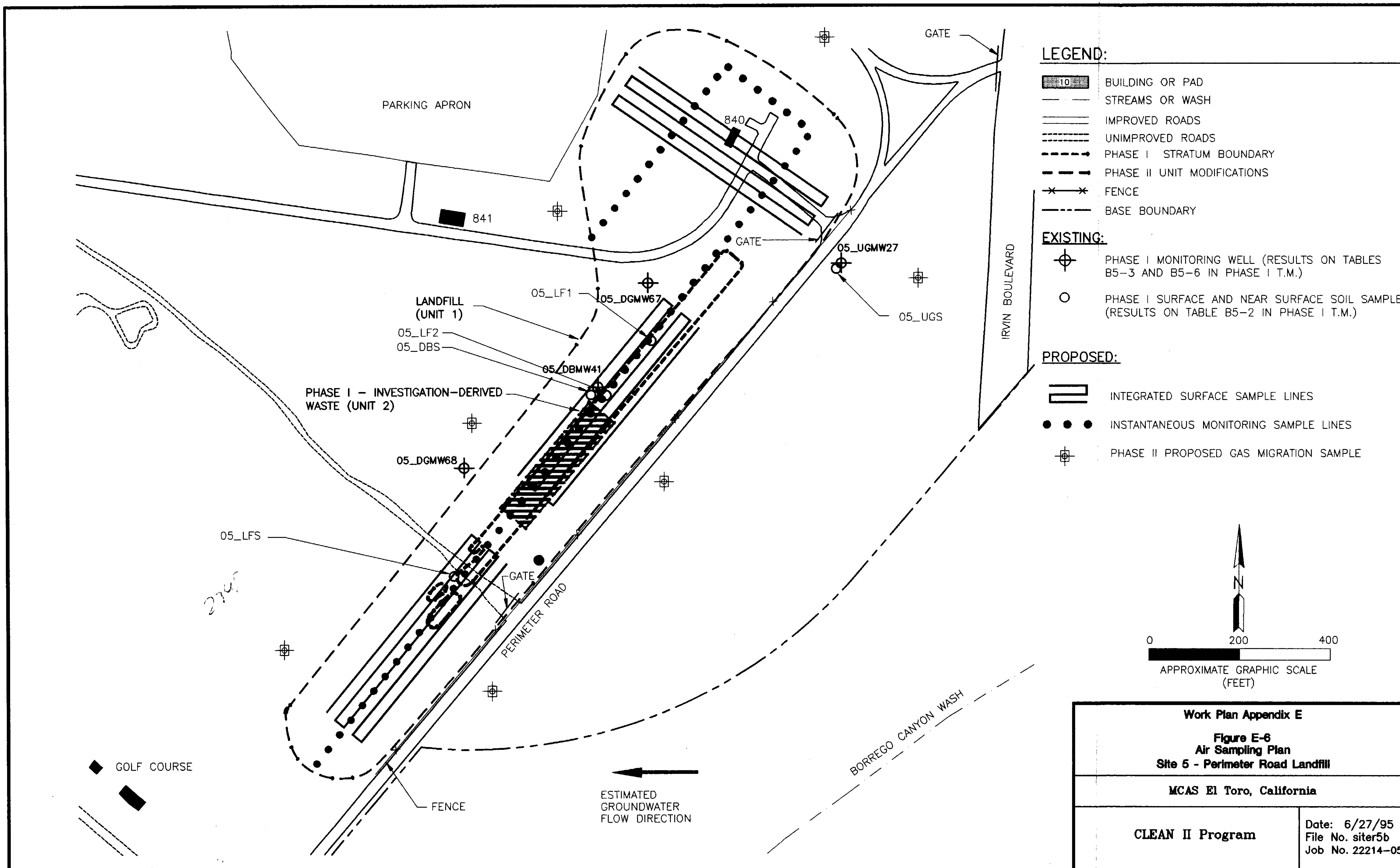
The general locations for Phase II RI sampling of air emissions at Site 5 correspond with areas of suspected landfilled waste, as depicted in Figure E-6. These will be refined as information is generated from geophysical surveys associated with defining the limits of landfilled solid waste.

## Unit 1: Landfill Area– Groundwater Quality

Leachate production and migration, liquid waste migration, and surface water percolation and transport of contaminants, have the potential for impacting groundwater. The objective of this portion of the Phase II RI is to install an additional groundwater monitoring well and collect additional groundwater data to assess groundwater quality at the site, evaluate whether the landfilled wastes have impacted groundwater, and to establish a compliance monitoring network. If groundwater contamination is observed from Site 5 Phase II well installation and sampling, additional wells may be constructed and sampled to estimate the extent of contamination. For risk assessment purposes, the contaminant concentrations in groundwater will be compared with U.S. EPA MCLs, as per the Safe Drinking Water Act.

Aside from answering the question of whether groundwater is impacted from landfilled wastes, data collected in this phase may also be used to conceptually design engineered remedial option(s), if impacts have occurred. The following techniques will be used to achieve these goals:

- existing wells will be sampled and analyzed for COPCs; groundwater elevations will also be measured to estimate gradient and flow direction;
- new wells will be installed where necessary to estimate groundwater gradient and flow direction at the site, and to help assure sampling of groundwater downgradient from landfilled wastes; these new wells will also be sampled and analyzed for COPCs; and




**Work Plan Appendix E**

**Figure E-6**
**Air Sampling Plan**
**Site 5 - Perimeter Road Landfill**

**MCAS El Toro, California**

**CLEAN II Program**

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- results from the above activities will be used to assess potential groundwater impacts.

Due to the uncertainty of the landfill boundary, an additional well may be installed upon completion of defining the limits of the landfilled wastes. The final number and locations of these borings will depend on the results of the Tier 1 investigations.

At the conclusion of defining the limits of landfilled wastes, as part of Tier 2 activities one new downgradient monitoring well may be installed to assess water quality. The existing wells and the proposed location of the downgradient well are shown on Figure E-2.

If groundwater contamination is observed from Site 5 additional Tier 2 field investigations will be performed, as necessary, to obtain site-specific data for the following objectives:

- estimating the lateral and vertical extent of groundwater contamination;
- documenting seasonal variations in groundwater elevations;
- assessing potential buried waste saturation due to groundwater recharge in Borrego Canyon Wash; and
- performing aquifer tests to collect hydrogeological parameters necessary for evaluating possible groundwater containment or remediation.

## Unit 1: Landfill Area– Sample Vadose Zone Below Landfill

As suggested in the previous subsection, groundwater may be impacted due to migrating leachate or liquid wastes. If groundwater has not been impacted, then soil sampling using angled borings will be performed to assess potential landfill impacts to vadose zone soils. Vadose zone monitoring equipment (i.e., soil vapor probe) will be installed in selected borings to assess the migration of landfill contaminants for vadose zone compliance monitoring. The soil samples collected during drilling will be analyzed for the COPCs identified in the DQO process. For compliance monitoring, two vadose zone borings will be advanced under the landfill and equipped with vapor probes.

The final number and locations of these borings will depend on the results of the groundwater investigations.

At the conclusion of groundwater-related activities, the following Tier 2 activity will be performed, as necessary.

- A minimum of two slanted borings will be drilled and sampled adjacent to the main disposal area of Site 5. The borings will be cased and a permanent sampling probe will be installed in the borings to collect leachate and/or gas that has migrated beneath the refuse into the vadose zone.

## Unit 2: Stockpiled Investigation–Derived Waste Soil

Unit 2 is composed of stockpiled designated and nonhazardous soil consisting of Phase I RI IDW. Based on existing data available as to the source of the stockpiles, no sampling activities are planned for this unit. Potential disposal options will be evaluated including:

- reuse soil as fill,
- landfilling in one of the MCAS El Toro landfills,
- landfilling at an off-site landfill, and
- recycling by thermal desorption.

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SAIC. *See* Science Applications International Corporation.

SCAQMD. *See* South Coast Air Quality Management District.

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## WORK PLAN APPENDIX F

# DATA QUALITY OBJECTIVES
# OPERABLE UNIT 3 –
# SITE 6 – DROP TANK DRAINAGE AREA NO. 1

# SUMMARY

## STEP 1 – STATE THE PROBLEM

Site 6, the Drop Tank Drainage Area No. 1, is a grassy area adjacent to an aircraft parking apron where residual fuel was emptied from aircraft drop tanks and the tanks were cleaned. The mixture of residual jet fuel and wash water drained from the concrete apron onto the adjacent grassy area and has impacted soil in that area. Soil at this site has also been impacted by spillage of drummed waste oil. The human health and ecological risks associated with the impacted soil will be estimated so that a No Further Investigation or the appropriate remedial alternative can be recommended.

## STEP 2 – IDENTIFY THE DECISION

The Phase II Remedial Investigation/Feasibility Study decisions to be considered at Site 6 are as follows: Do chemicals of potential concern in the shallow soil at Site 6 present an unacceptable risk to human health and the environment? Are the chemicals of potential concern present in the subsurface soil (greater than 10 feet below ground surface), and if so, do they present an unacceptable risk to groundwater? The possible decision outcomes are recommendations for No Further Investigation, Early Action, or Long-Term Action.

## STEP 3 – IDENTIFY THE INPUTS AFFECTING THE DECISION

Inputs necessary to make these decisions include a list of chemicals of potential concern; the extent of impacted media; the background (ambient) concentrations of metals, herbicides, and pesticides; and the action levels for protection of human health and the environment.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

The study is limited to the geographic area of Site 6, which comprises three subareas: 1) the concrete pad apron edge (approximately 90,000 square feet); 2) the drainage area from the concrete pad to the catch basin (approximately 250,000 square feet); and 3) a storage area (approximately 100,000 square feet).

## STEP 5 – DEVELOP A DECISION RULE

Action levels developed for decision-making purposes are a cumulative excess cancer risk of $10^{-6}$ in humans and a hazard index of 1.0 for chronic systemic toxicity in humans. Based on these risk levels, decision rules have been formulated to protect human health and the environment in residential, recreational, and industrial land use scenarios.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The number of samples necessary to estimate different levels of risk were calculated using the confidence level of 95 percent and power level of 80 percent limits specified for this project. The preliminary cancer and noncancer risk values were compared to the risk levels, and the appropriate number of samples necessary to estimate risk were selected for each unit.

## STEP 7 – OPTIMIZE THE DESIGN

Shallow soil samples will be collected and will be analyzed at 0, 5, and 10 feet below ground surface at two locations adjacent to the concrete apron edge, three locations within the drainage ditch, and three locations within the storage area to assess soil impacted by historic operations at this site.

# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| AOC | area of concern |
| ARAR | applicable or relevant and appropriate requirement |
| BCT | BRAC Cleanup Team |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure |
| COPC | chemical of potential concern |
| CRDL | contract-required detection limit |
| DQO | data quality objective |
| EE/CA | Engineering Evaluation/Cost Analysis |
| FS | Feasibility Study |
| FSP | Field Sampling Plan |
| IDL | instrument detection limit |
| MCAS | Marine Corps Air Station |
| MCL | maximum contaminant level |
| µg/kg | micrograms per kilogram |
| µg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| ND | nondetect |
| NEESA | Naval Energy and Environmental Support Activity |
| NFESC | Naval Facilities Engineering Service Center |
| NFI | No Further Investigation |
| PAH | polynuclear aromatic hydrocarbons |
| PRG | (U.S. EPA Region IX) Preliminary Remediation Goal |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA Facility Assessment |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| SAIC | Science Applications International Corporation |
| SVOC | semivolatile organic compound |
| SWMU | solid waste management unit |

## ACRONYMS/ABBREVIATIONS (continued)

| | |
|---|---|
| TAL | target analyte list |
| TDS | total dissolved solids |
| TFH | total fuel hydrocarbons |
| TRPH | total recoverable petroleum hydrocarbons |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |

## Appendix F

# SITE 6 – DROP TANK DRAINAGE AREA NO. 1

The United States Environmental Protection Agency (U.S. EPA) developed the data quality objectives (DQO) process as a tool for project managers to determine the type, quantity, and quality of data needed to make decisions. Data produced by sampling and monitoring activities are used extensively in problem definition, rule-making, and enforcement decisions. These activities are supported through implementation of the mandatory U.S. EPA Quality System, which requires all organizations to develop and operate management processes and structures for assuring that the data collected are of the necessary and expected quality for their desired use (U.S. EPA 1993).

The U.S. EPA DQO process consists of the following seven steps.

1. **State the problem:** Describe the problem at the site as it is currently understood. The problem statement includes a site conceptual model and an organization and review of all relevant data.
2. **Identify the decision:** Determine an if-then statement that will define what the investigation will seek to determine and what actions will be taken based on the possible outcomes of the investigation.
3. **Identify inputs into the decision:** Specify the analytes or parameters to be measured and used.
4. **Define the study boundary:** Delineate the study boundary from information obtained from Step 1.
5. **Develop a decision rule:** Restate the decision detailing the if-then statement in specific terms.
6. **Specify acceptable limits on decision errors:** Specify how the data will be treated statistically and what the acceptable limits of uncertainty are.
7. **Optimize the design:** Design the field investigation, giving adequate consideration to the results of Steps 5 and 6. This step is described in more detail in the Field Sampling Plan (FSP).

The following sections describe the DQO process for Site 6 – Drop Tank Drainage Area No. 1.

## STEP 1 – STATE THE PROBLEM

Site 6 is a grassy area adjacent to an aircraft parking apron where residual fuel was emptied from aircraft drop tanks and the tanks were cleaned. The mixture of residual jet fuel and wash water drained from the concrete apron onto the adjacent grassy area and has impacted soil in that area. Soil at this site has also been impacted by spillage of drummed waste oil.

### Site Description

Site 6, the Drop Tank Drainage Area No. 1, is a concrete apron bordered by a grassy area located southwest of Building 727 in the southwest quadrant of Marine Corps Air Station (MCAS) El Toro (Figure F-1). Site 6 comprises three areas: 1) the concrete pad apron edge; 2) the drainage ditch running from the concrete pad edge to a catch basin; and 3) the storage area. Site boundaries for MCAS El Toro Phase I Remedial Investigation (RI) were determined by consensus between the Navy and the regulatory agencies prior to initiation of the Phase I RI. Areas of concern were generally grouped together into sites based on common historical activities, aerial photographic review, and their locations respective to each other.

From approximately 1969 to 1983, aircraft drop tanks were transported to Site 6 where their remaining fuel was drained. Residual JP-5 fuel in the tanks was washed out onto the concrete apron and the combined fuel-wash/rinse water ran off onto the adjacent grassy area. In addition to fuels, waste lubricant oils from maintenance operations were also reportedly stored in drums and staged in the area. From 1969 to 1983, approximately 1,400 gallons of JP-5 fuel was drained from the drop tanks onto the concrete apron and washed onto adjacent vegetated areas. Also, an estimated 300 gallons of waste oils were spilled at Site 6 (Jacobs Engineering 1993a).

The terrain in the immediate vicinity of the site is sloped slightly to the west. Surface drainage from the site is directed westward by a small swale that drains into a ditch. The ditch empties into a catch basin that discharges into the Agua Chinon Wash.

## PREVIOUS INVESTIGATIONS

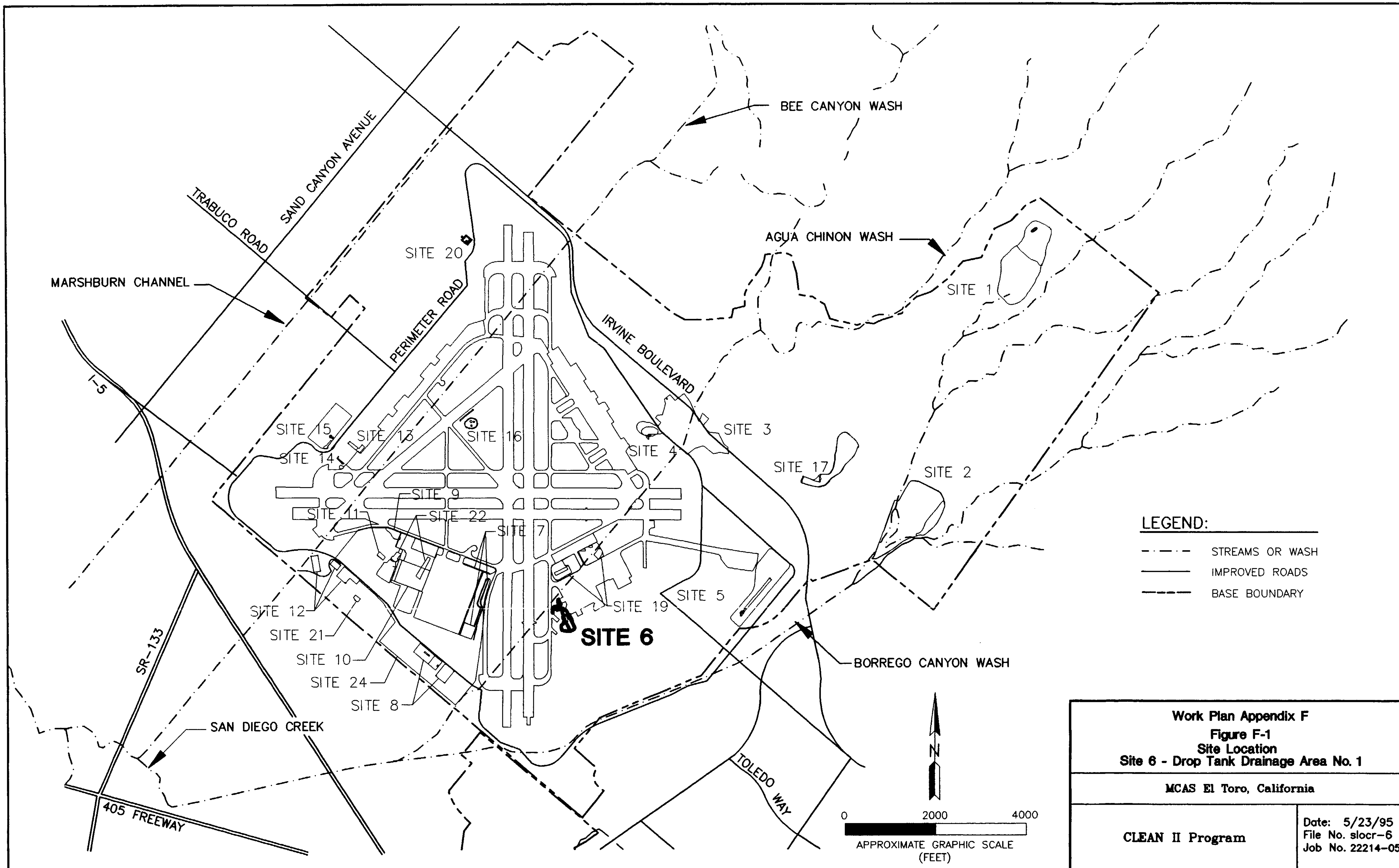
Several investigations have been conducted at Site 6. These include the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA), the Phase I RI, aerial photographic surveys, and employee interviews. The sections below provide a summary of these investigations.

### RCRA FACILITIES ASSESSMENT

During the RFA for MCAS El Toro, solid waste management units (SWMUs)/areas of concern (AOCs) 204 (aircraft wash rack) and 236 (storage area) were identified at or adjacent to Site 6. SWMU/AOC 204, a concrete padded aircraft wash rack located north of Site 6, was investigated during the RFA (Jacobs Engineering 1993b). The concrete pad is curbed and all wash water is collected in a sump and pumped out occasionally by an outside contractor. During the RFA, the following activities were conducted for SWMU/AOC 204:

- four borings were drilled to a depth of 5 feet below the concrete;
- soil samples were collected at 2 and 5 feet below ground surface (bgs); and
- soil samples were analyzed for volatile organic compounds (VOCs) and total recoverable petroleum hydrocarbons (TRPH).

The RFA analytical results are summarized below. For a complete listing of chemicals of potential concern (COPCs), refer to the Final RFA, Volume I (Jacobs Engineering 1993b):




**Work Plan Appendix F**
**Figure F-1**
**Site Location**
**Site 6 - Drop Tank Drainage Area No. 1**

MCAS El Toro, California

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- VOCs: acetone (17 to 39 micrograms per kilogram [µg/kg]), methylene chloride (6BJ to 15B µg/kg); and
- petroleum hydrocarbons: TRPH (ND*)

*ND = Nondetect (i.e., not detected above the detection limit for U.S. EPA Method 418.1).

The RFA suggested No Further Investigation (NFI) at SWMU/AOC 204.

The other SWMU/AOC identified at Site 6 during the RFA, SWMU/AOC 236, is a drum storage area located at Building 727, just north of Building 458. The exact location of this SWMU/AOC is not known. This site is located within the boundaries of RI/Feasibility Study (FS) Site 6; therefore, it was not investigated during the RFA. This area will be evaluated as part of the Unit 3 Phase II RI/FS for Site 6, with limited sampling conducted during this investigation. There are no indications that suggest any releases have occurred at this location. Therefore, investigation of this SWMU/AOC may be limited to an RFA-type site inspection (Jacobs Engineering 1993b), unless evidence of a release at either location is identified during the inspection.

## PHASE I REMEDIAL INVESTIGATION

For the Phase I RI, subareas within sites were designated as strata. Due to the fact that some new subareas have been added or subareas have been expanded or diminished for the Phase II (RI/FS), subareas within sites will be referred to as units for the Phase II RI/FS. In this section, discussion is related to Phase I RI sampling and results and the term strata will be used. Following this section, the term unit will be used.

For the Phase I RI, Site 6 was represented by three strata:

- Stratum 1 – Concrete Pad Apron Edge (the soil around the edge of the pad);
- Stratum 2 – Drainage (the drainage area from the pad to the catch basin); and
- Stratum 3 – Storage Area (the former drum storage area).

The following field activities were conducted as part of the Phase I RI:

- shallow soil samples were collected from 12 sample stations (three each from Strata 1, 2, and 3, one each at the upgradient and deep boring locations; and one in the catch basin;
- one deep boring was drilled and sampled;
- one upgradient monitoring well (06_UGMW28) was drilled, installed, and sampled;
- one downgradient monitoring well (06_DGMW69) was drilled, installed, and sampled;
- soil samples were analyzed for target analyte list (TAL) metals, VOCs, semivolatile organic compounds (SVOCs), and petroleum hydrocarbons; and

- groundwater samples were analyzed for general chemistry, TAL metals, VOCs, SVOCs, total fuel hydrocarbons (TFH)-diesel and -gasoline, and TRPH.

A summary of the ranges of analyte concentrations detected during the Phase I RI (sample identification of the highest concentration is provided) plus recent groundwater monitoring data are presented below. All COPCs that were detected in soil are listed with the exception of specific metals, which are listed only if U.S. EPA Region IX Preliminary Remediation Goals (PRGs) or ecological screening criteria in shallow soil were exceeded. All COPCs exceeding PRGs or maximum contaminant levels (MCLs) in groundwater are included in this list. If a minimum concentration is recorded with a "less than" symbol, it denotes a concentration below the U.S. EPA Contract Laboratory Program detection limit. Sample locations are shown on Figure F-2. A complete listing of all detected chemicals is presented in the Phase I RI Technical Memorandum, Appendix B-6, Tables B6-2 through B6-7 (Jacobs Engineering 1993c), and in the Groundwater Quality Data Report (Jacobs Engineering 1994a). TAL metals that were analyzed during the Phase I RI are beryllium, barium, arsenic, antimony, aluminum, cadmium, calcium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

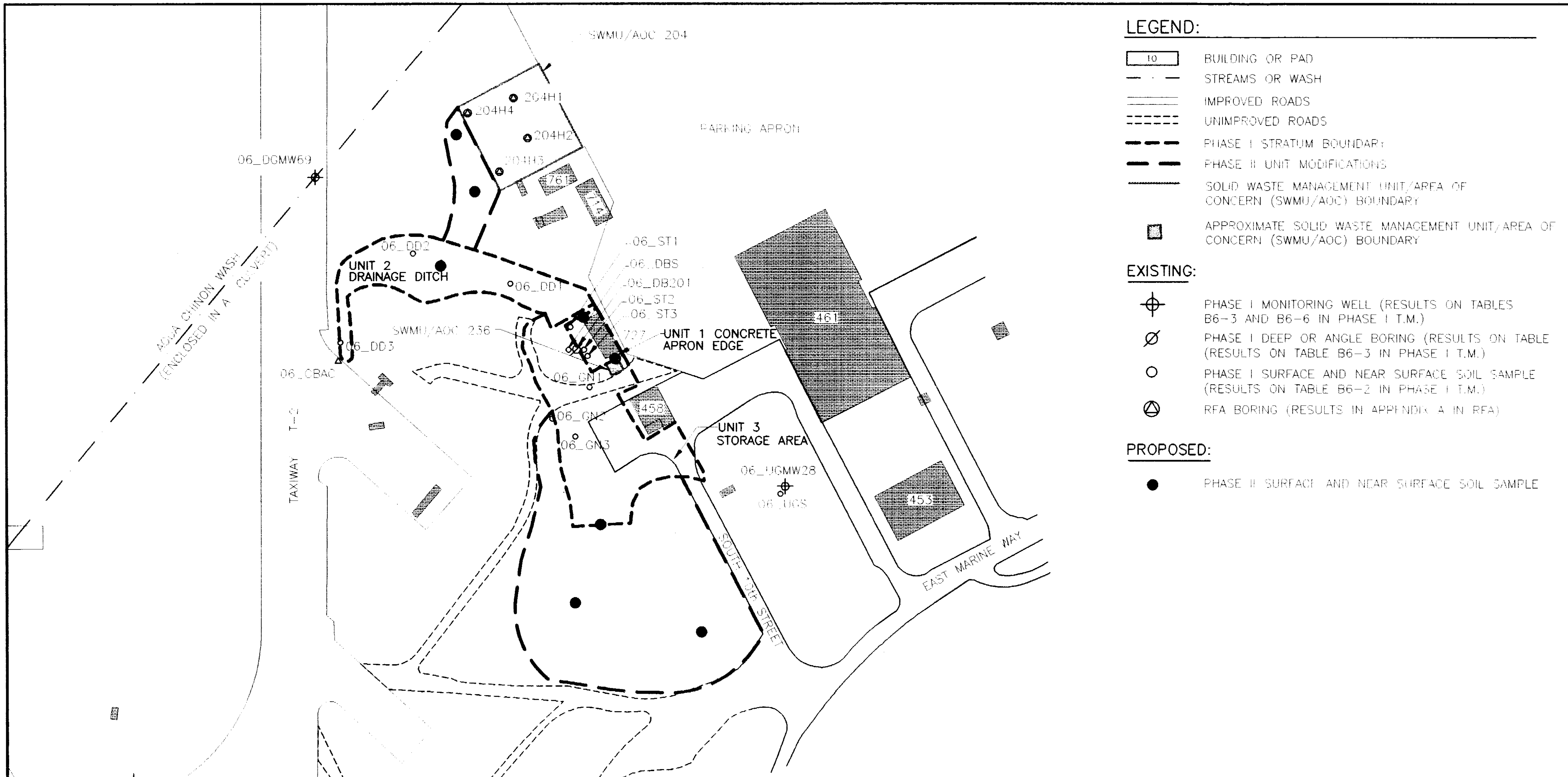
### *Shallow Soil (less than 10 feet below ground surface)*

- metals: antimony (< 2.5U to 5.3B milligrams per kilogram [mg/kg] [06_GN3 at 0 feet]), barium (< 0.48 to 1280 mg/kg [06_DD1 at 0 feet]), chromium (5.5 to 365 mg/kg [06_GN3 at 0 feet), lead (2.8 to 1410 mg/kg [06_GN3 at 0 feet), zinc (22.9 to 266 mg/kg [06_DD1 at 0 feet), and 17 TAL metals;
- VOCs: acetone (< 10 to 49B µg/kg [06_DD1 at 0 feet]), carbon tetrachloride (< 10 to 7J µg/kg [06_DBS at 0 feet]), methylene chloride (less than 10 to 31B µg/kg [06_CBAC at 0 feet]), toluene (< 10 to 10J µg/kg [06_DD2 at 0 feet]);
- SVOCs: benzyl butyl phthalate (< 670 to 440J µg/kg [06_DBS at 0 feet]), bis(2-ethylhexyl)phthalate (< 670 to 14,000 µg/kg [06_GN3 at 0 feet]), fluoranthene (< 680 to 160J µg/kg [06_DD1 at 0 feet]), pyrene (< to 150J µg/kg [06_DD1 at 0 feet]), and;

fuel and petroleum hydrocarbons: TFH-diesel (< 12.8 to 239 mg/kg [06_GN3 at 0 feet]), TFH-gasoline (< 0.052 to 315 mg/kg [06_CABC at 0 feet]), and TRPH (< 20 to 1297 mg/kg [06_ST3 at 0 feet]).

### *Subsurface Soil (greater than 10 feet below ground surface)*

- metals: 21 of 23 TAL metals;
- VOCs: 2-hexanone (< 10 to 13 µg/kg [06_DB201 at 5 feet]), acetone (< 10 to 31 µg/kg [06_DGMW69 at 120 feet]), methylene chloride (< 10 to 6J µg/kg [06_DB201 at 10 feet]), toluene (< 10 to 6J µg/kg [06_DB201 at 5 feet]), xylenes (< 10 to 4J µg/kg [06_DB201 at 5 feet]); and
- fuel and petroleum hydrocarbons: TFH-gasoline (< 0.052 to 0.058 mg/kg [06_DGMW69 at 120 feet]).




**Work Plan Appendix F**

**Figure F-2**
**Site Plan**
**Site 6 - Drop Tank Drainage Area No. 1**

**MCAS El Toro, California**

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***Groundwater (06_UGMW28 upgradient)***

- general chemistry: chloride (494 to 541 milligrams per liter [mg/L] [06_UG28]), nitrate/nitrite-N (18.8 to 20.4 [06_UGMW28]) sulfate (277 to 332 mg/L [06_UGMW28]), and total dissolved solids (TDS) (1,890 to 2,180 mg/L [06_UGMW28]);
- metals: antimony (< 19.8 to 19.6 micrograms per liter [µg/L] [06_UGMW28]), manganese (37.7 to 197 µg/L [06_UGMW28]), nickel (230 to 643 µg/L [06_UGMW28]), selenium (56.2 to 58.2 µg/L [06_UGMW28]), and 8 other of 23 TAL metals;
- VOCs: methyl chloride (< 2 to 2J µg/L [06_DGMW69]); and
- SVOCs: benzyl butyl phthalate (< 10 to 3J µg/L [06_UGMW28]).

***Groundwater (06_DGMW69 downgradient)***

- general chemistry: nitrate/nitrite-N (15.1 to 16.3 mg/L), chloride (283 to 286 mg/L), and TDS (1,080 to 1,330 mg/L);
- metals: antimony (< 19.8 to 12.9B µg/L), cadmium (< 1.4 to 15.3 µg/L), nickel (434 to 866 µg/L), and 12 of 23 TAL metals;
- VOCs: 1,1,1 trichloroethane (< 2 to 0.4J µg/L); and
- SVOCs: phenol (<10 to 14 µg/L).

J = Indicates an estimated value for qualitative use only (organic parameters).

B = Indicates reported value is less than the contract-required detection limit (CRDL), but greater than the or equal to the instrument detection limit (IDL) (inorganic parameters).

U = undetected at detect limits

PRGs and ecological screening criteria were compared with corresponding shallow soil analytical results. The results of these comparisons are below:

- lead exceeds PRGs in Stratum 3 and ecological criteria in Stratum 1;
- antimony, barium, lead, and zinc exceed ecological criteria in Stratum 2; and
- chromium, lead, antimony, and zinc exceed ecological criteria for Stratum 3.

Groundwater samples were collected from two groundwater monitoring wells (06_UGMW28 and 06_DGMW69) constructed near Site 6. COPCs detected in groundwater samples were compared to PRGs and MCLs:

- antimony, manganese, and nitrate exceed PRGs in the upgradient well (04_UGMW28);
- nickel and nitrate exceed PRGs in the downgradient well (04_DGMW69);

- antimony, manganese, nickel, selenium, nitrate, chloride, sulfate and TDS exceed MCLs in the upgradient well; and
- antimony, cadmium, nickel, nitrate, chloride, and TDS exceed MCLs in the downgradient well.

Analytical data indicated that no site-related contaminants were identified in groundwater from these wells (Jacobs Engineering 1993a).

### U.S. EPA AERIAL PHOTOGRAPH SURVEY

The U.S. EPA aerial photographic survey performed for MCAS El Toro first identified vertical tanks and open storage features in U.S. EPA photographs from 1952. By 1970, the storage area had been enlarged, and a liquid flow can be seen in photographs on an area north of the site. The liquid ends in a stained area as evident on the 1970, 1980, and 1981 photographs (Jacobs Engineering 1993a).

### SAIC AERIAL PHOTOGRAPH SURVEY

The Science Applications International Corporation survey identified staining at Site 6 in the 1961 and 1968 photographs. Two open storage areas, inside and south of Unit 3, are present on the 1973 photograph. The 1974 photograph shows stains in the area of Buildings 714 and 761. On the 1976 photo, wet soil, a stained area, and a possible liquid are noted in the Site 6 area (SAIC 1993).

### EMPLOYEE INTERVIEWS

On 26 May 1994 a meeting was held at MCAS El Toro to interview active and retired personnel from the Station Fuel Operations Division and Facility Management Department (currently the Installations Department) who had knowledge of Station operations and procedures for storage/disposal of hazardous materials and waste. Participating as interviewers during the meeting were agency personnel, Navy and Station personnel, and personnel from the contractors for the Navy and the U.S. EPA. During these interviews, employees who said they had been working at MCAS El Toro since the 1970s, confirmed that drop tanks had been washed out on the pad at Site 6 (Jacobs 1994b).

During a site visit on 6 October 1994, drop tanks were observed on a concrete pad north of Site 6. In addition, drop tank storage racks and the triangular impoundment were observed in a grassy area comprising the eastern and southern portions of Site 6.

## Geology

The geology of Site 6 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993a). Holocene deposits consist of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene, which are considered to be bedrock in the area.

Based on a review of boring logs from the Phase I RI, the subsurface lithology at Site 6 consists predominantly of well graded to silty sands that are mixed and interbedded with silts and clays. Within the sand units are occasional gravels, which are probably associated with stream channels.

## Hydrogeology

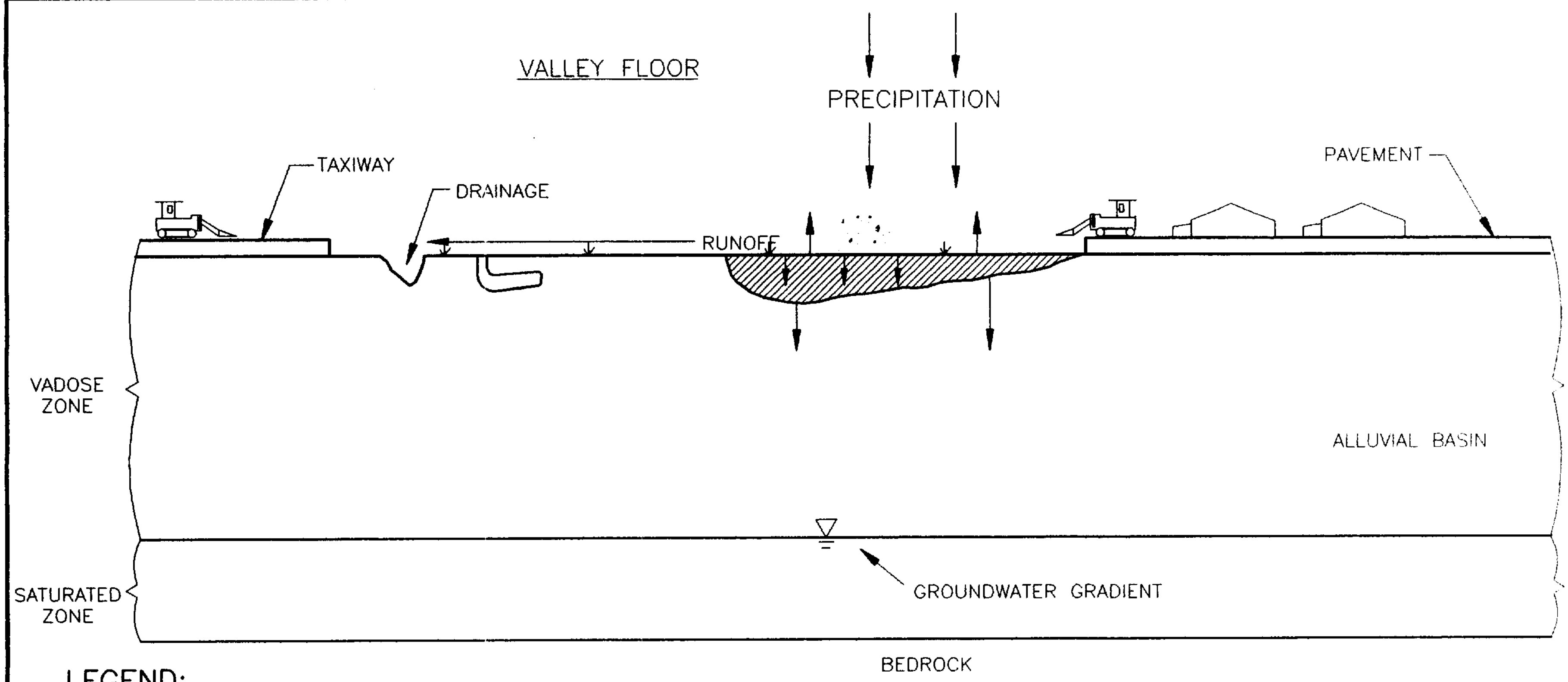
MCAS El Toro is located within the Irvine Groundwater Basin, which is a subbasin of the Los Angeles groundwater basin. Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine-grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993c).

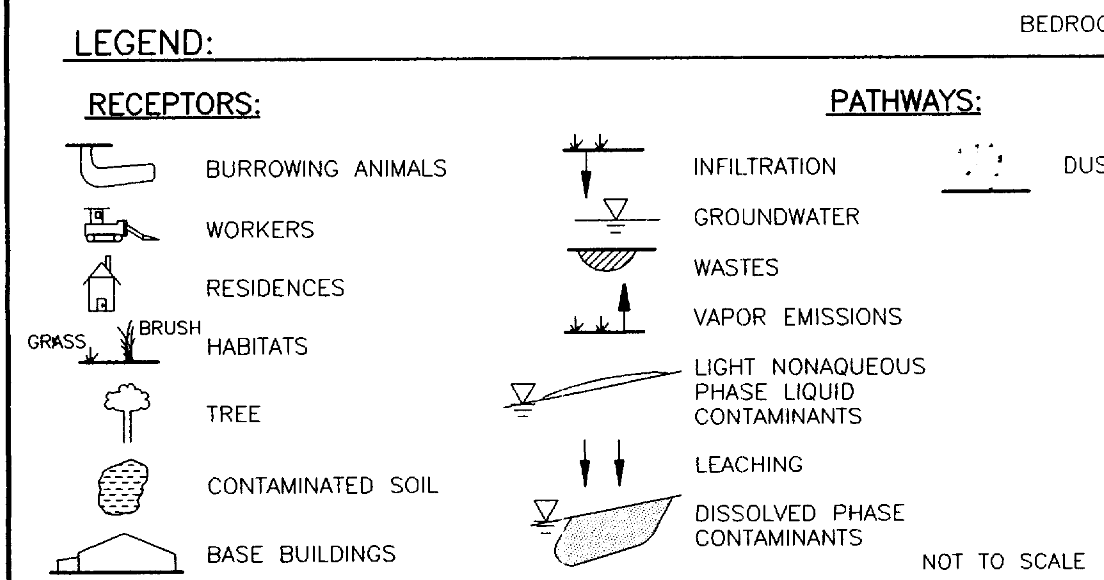
The Phase I RI results indicate that the shallow, perched zone is not present at Site 6. The principal aquifer, at a depth of 145 feet beneath Site 6, is the main water-producing zone for the Irvine area and is of primary interest to this investigation. The regional groundwater flow direction is generally to the northwest. The local hydraulic gradient has been influenced strongly by the pumping of irrigation wells located west of MCAS El Toro.

## Conceptual Site Model

In the process of developing a conceptual site model, release mechanisms and potential sources of contamination were considered and evaluated to determine their applicability to the site. Also considered in the development of the conceptual site model were potential receptors and contaminant pathways to potential receptors. Figure F-3 illustrates the conceptual site model developed for the site. Figure F-4 depicts the potential exposure routes and pathways for human and ecological receptors.

The primary release mechanism is contaminants released to shallow soil from disposal activities at this site. Eventually under gravity, contaminants present in shallow soil may move downward with soil moisture (in dissolved phase) or in a liquid phase. The depth of groundwater is recorded to be about 145 bgs.




**Work Plan Appendix F**

**Figure F-3**

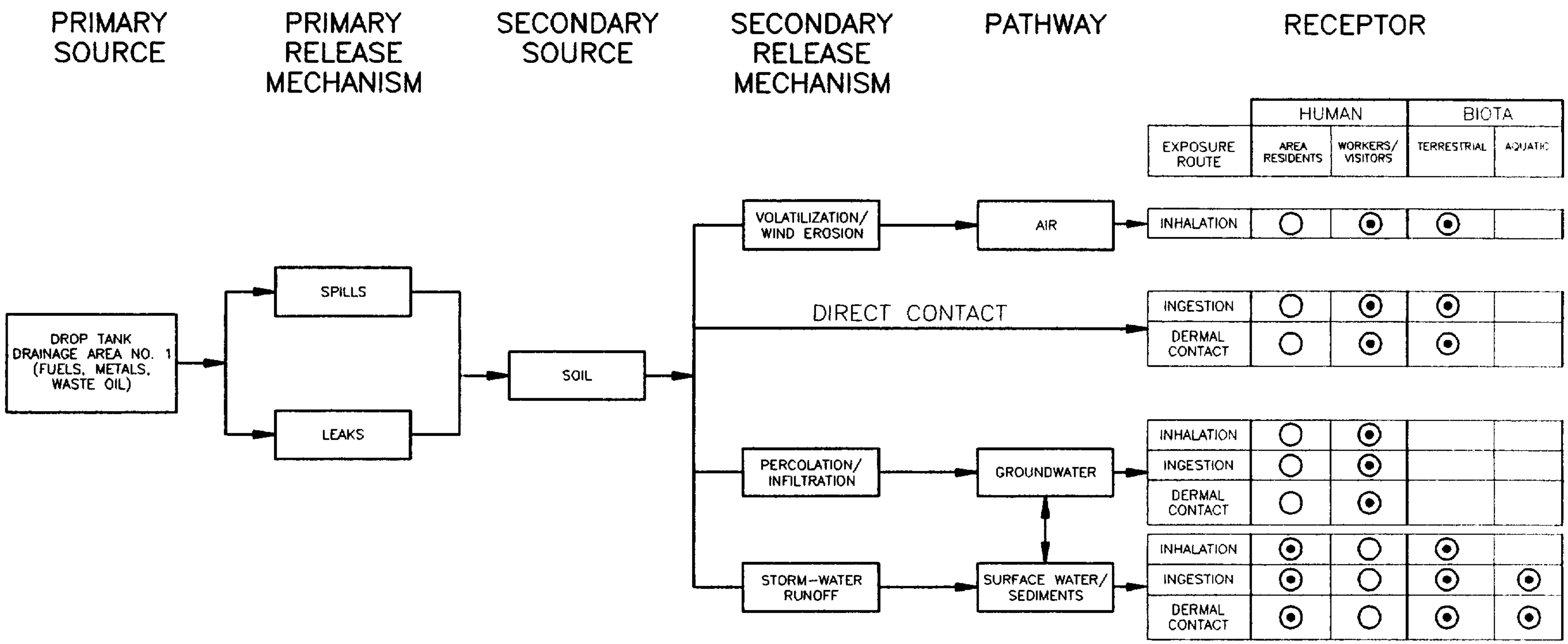
**Conceptual Site Model**

**Site 6 - Drop Tank Drainage Area No. 1**

MCAS El Toro, California

CLEAN II Program

Date: 7/3/95
File No. model-6
Job No. 22214-059




LEGEND:

● CURRENT POTENTIAL RECEPTOR

○ FUTURE POTENTIAL RECEPTOR

**Work Plan Appendix F**

**Figure F-4**

**Exposure Routes and Receptors**
**Site 6 - Drop Tank Drainage Area No. 1**

**MCAS El Toro, California**

CLEAN II Program

Date: 6/28/95
File No. mod6
Job No. 22214-059

The secondary source of contaminants is the surrounding soil impacted by disposal activities. One secondary release mechanism is the dust brought into suspension in the air by wind. The fine particles of dust may contain all potential contaminants. Storm water runoff may form another secondary release mechanism. Storm water carries contaminants in dissolved forms, colloidal forms, or associated with suspended soil particles.

The potential pathways are air, groundwater, and surface water. Airborne contaminants are transported through fugitive dust and volatilization. The transport through air is affected by wind speed and direction, type of contaminant, and weather condition. Typical wind condition at MCAS El Toro is from west/southwest at less than 10 knots. Transportation of airborne contaminants through volatilization is expected to be unimportant at this site. Surface water transport is affected by the amount of rainfall, type of contaminant, surface soil properties and the topography of the area. The mean annual rainfall at MCAS El Toro is about 14.0 inches, most of it occurs from November through April.

Current and/or potential receptors of chemicals at this site via inhalation are workers and visitors involved in disposal activities. Direct contact with surface and subsurface soils is currently possible via dermal or ingestion exposures of workers. Infiltration of contaminated water through the vadose zone into groundwater is possible because subsurface soil is mainly sands, with some silts and clays. However, current exposure of workers is unlikely via ingestion of groundwater at this site.

Terrestrial wildlife could be exposed to chemicals in on-site surface soil, and dust and vapors through ingestion, dermal absorption or inhalation. Terrestrial plants could also be exposed through root absorption of chemicals in surface soil or deposition of dusts. No special-status species were observed at this site, and the immediate area provides marginal habitat for wildlife species.

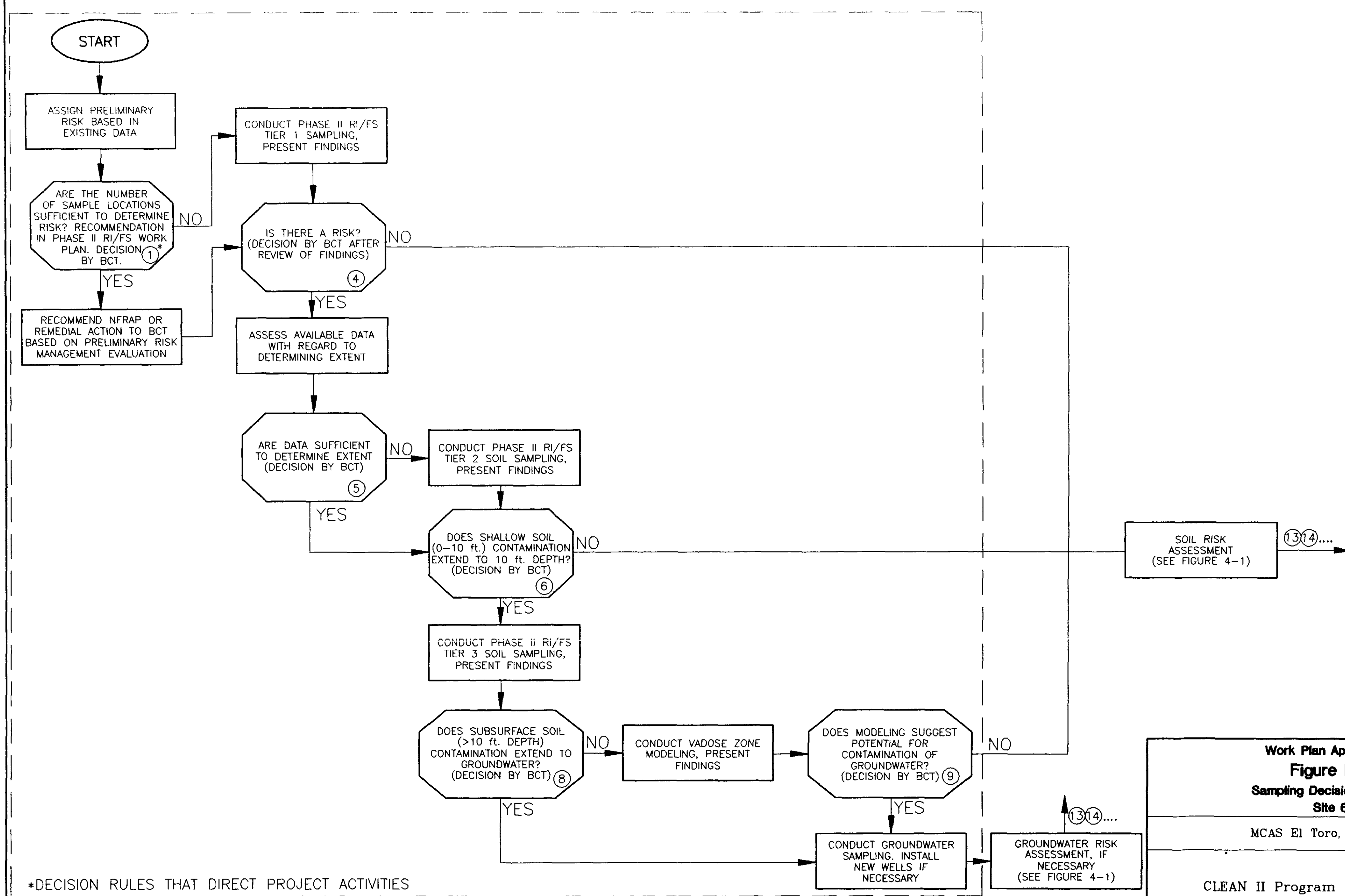
### Statement of Phase II RI/FS Problem

Site 6 is a concrete apron bordered by a grassy area located southwest of Building 727 in the southern quadrant of MCAS El Toro. The problems associated with this site are the following:

- shallow soil is impacted with VOCs, SVOCs, and petroleum hydrocarbons;
- several metals exceed PRGs and ecological criteria; and
- additional data are necessary to calculate a cumulative excess cancer risk and hazard index for the site.

## STEP 2 – IDENTIFY THE DECISION

This step describes the decisions that will be considered during the DQO process for Site 6. For each decision, the alternative outcomes are stated. The Sampling Decision Process is illustrated on Figure F-5. For Site 6, the following decisions will be considered:




**Work Plan Appendix F**

**Figure F-5**

**Sampling Decision Process**

**Site 6**

MCAS El Toro, California

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| CLEAN II Program | Date: 3/11/95<br>File No. Logicr6<br>Job No. 22214-059 |

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1. Do COPCs in shallow soil (less than 10 feet bgs) in the unit exceed established background concentrations and PRGs, and/or do they present an unacceptable risk to human health or the environment?

   If yes, proceed to the next decision.

   If uncertain, collect additional soil samples to determine risk.

   If no, recommend the unit for NFI.

2. Has the extent of impacted soil been defined in the shallow soil?

   If yes, evaluate a response action.

   If no, conduct soil sampling to define extent.

3. Does the extent of impacted shallow soil extend into the subsurface (greater than 10 feet bgs)?

   If yes, conduct soil sampling to define vertical extent of impacted soil, and if necessary, evaluate potential impacts to groundwater beneath the site.

   If no, evaluate a response action.

4. Does the media being evaluated for a response action qualify for Early Action?

   If yes, recommend unit for an Engineering Evaluation/Cost Analysis (EE/CA).

   If no, recommend unit for a remedial response as part of the RI/FS process.

# STEP 3 – IDENTIFY THE INPUT AFFECTING THE DECISION

Step 2 defined the decisions addressing possible actions at the site. Step 3 will identify the inputs that are required to assess the actions as discussed below:

## Inputs for No Further Investigation

Input information required to support an NFI recommendation will also be used to support decisions for Early Action and Long-Term Action. These inputs are as follows:

- list of COPCs;
- definition of the extent of impacted soil;
- background concentrations for metals, pesticides, and herbicides;
- determination of risk for the unit; and
- action levels for the protection of human health and the environment.

## Inputs for Early Action

In addition to the inputs required for an NFI recommendation, input information required to support an Early Action recommendation will include the following:

- applicable or relevant and appropriate requirements (ARARs),
- identification of cleanup standards,
- identification of cleanup technology applicability/limitations that are not extensive operation and maintenance activities, and
- site/unit cleanup in less than 5 years.

## Inputs for Long-Term Action

In addition to the inputs required for a NFI recommendation, input information required to support a Long-Term Action recommendation may include the following:

- ARARs;
- identification of cleanup standards,
- identification of cleanup technology applicability/limitations,
- pilot testing of remedial alternatives, and
- site/unit cleanup in more than 5 years.

## Descriptions of Inputs

The following sections provide brief discussions of the inputs to assess possible response actions.

### CHEMICALS OF POTENTIAL CONCERN

The COPCs at Site 6 include all chemicals detected in the Phase I RI for each media (Jacobs Engineering 1993c). COPCs for Site 6 are listed (by chemical class and media) below.

#### *Shallow Soil (less than 10 feet below ground surface)*

- metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, zinc;
- VOCs: acetone, methylene chloride, carbon tetrachloride, toluene, xylenes;
- SVOCs: fluoranthene, pyrene, benzyl butyl phthalate; and
- fuel and petroleum hydrocarbons: TRPH, TFH-gasoline, TFH-diesel.

#### *Subsurface Soil (greater than 10 feet below ground surface)*

- metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, zinc;

- VOCs: acetone, carbon tetrachloride, methylene chloride, xylene, 2-hexanone, toluene, xylenes;
- SVOCs: fluoranthene, pyrene, benzyl butyl phthalate; and
- fuel and petroleum hydrocarbons: TRPH, TFH-gasoline, TFH-diesel.

### *Groundwater – Upgradient*

- metals: antimony, arsenic, barium, cadmium, cobalt, manganese, mercury, nickel, selenium, vanadium, and zinc;
- VOCs: chloromethane; and
- SVOCs: benzyl butyl phthalate.

### *Groundwater – Downgradient*

- metals: aluminum, antimony, barium, cadmium, cobalt, manganese, mercury, nickel, selenium, vanadium, zinc;
- VOCs: 1,1,1 trichloroethane; and
- SVOCs: phenol.

## THE NATURE AND EXTENT OF CONTAMINATION

Phase II RI/FS sample locations, depths, and chemical analyses have been designed to assess the risk associated with the site. Additional sampling will be conducted if it is necessary to further define the extent of impacted shallow soil, subsurface soil, or groundwater.

## BACKGROUND CONCENTRATIONS

The background concentrations for metals, herbicides, and pesticides are presented in Section 4 of the Work Plan.

## DETERMINATION OF RISK

A determination of the human health risk associated with each site is based on a baseline or streamline risk assessment. Baseline risk assessments are performed on RI/FS sites. The objective of a baseline risk assessment is to estimate the risks associated with the no action alternative and thereby provide decision makers information useful in identifying the most appropriate remedial action alternative. The risk estimates produced also serve as a benchmark to which reductions in risk achieved by remedial actions may be compared. Streamlined risk assessments are performed on removal action sites to support the removal action.

In addition to the human health risk assessment conducted for a site, an ecological risk assessment may also be performed. The ecological risk assessment will evaluate current and potential risks to the environment posed by the chemical releases that have occurred at the sites.

### IDENTIFICATION OF CLEANUP LEVELS

Cleanup levels will be based on ARARs, background concentrations, and risk levels that will be determined for the site.

### CLEANUP TECHNOLOGY EFFECTIVENESS, IMPLEMENTABILITY, AND COSTS

Once cleanup levels have been established, the most appropriate and cost effective approach will be identified to remediate the site, if necessary.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

This step defines the spatial and temporal boundaries of the problem and any practical constraints that may interfere with the study:

- Unit 1 – the concrete pad apron edge (approximately 90,000 feet$^2$, has the same boundaries as the Phase I RI, Site 6, Stratum 1).
- Unit 2 – the drainage area from the pad to the catch basin, including possible surface drainage from SWMU/AOC 204 (approximately 25,000 feet$^2$, has been enlarged from the boundaries of the Phase I RI, Site 6, Stratum 2, to include the drainage from SWMU/AOC 204).
- Unit 3 – the storage area (approximately 100,000 feet$^2$, which includes all of Phase I RI Site 6 Stratum 3; SWMU/AOC 236 located north of Building 458 and not investigated as part of the RFA; and an area to the south, which includes the area containing drop tank storage racks and a triangular impoundment).

Specification of temporal boundaries for the field sampling activities is unnecessary. Shallow and deeper subsurface soil conditions are not considered to be significantly different from conditions during the Phase I RI sampling or throughout the period since spillage or unregulated waste disposal activities occurred on the site.

## STEP 5 – DEVELOP A DECISION RULE

Decision rules are required to state explicitly the types of inputs and logical basis for choosing among alternative actions during the Phase II RI/FS. A list of all decision rules for the project are included in Section 4 of the Work Plan. The specific decision rules that will be followed to determine an action are presented here. These decision rules conform to the numbering sequence presented in Section 4 of the Work Plan.

2. If Phase I data are sufficient to assess a response action to reduce risk associated with site units which exceed media action levels or background concentrations, then the cleanup levels and appropriate response action (Early Action or Long-Term Action) will be determined.
3. If Phase I data are not sufficient to assess whether risks are present based on the minimum number of samples, then Tier 1 sampling of the Phase II RI/FS will be completed to supplement the Phase I analytical results so the minimum number of

samples is satisfied to assess whether action levels or background concentrations are exceeded in site units.

4. If Phase I data and Tier I data for the Phase II RI/FS indicate that no solid wastes are exposed and respective action levels or background concentrations for the various media of a site unit are not exceeded, then NFI will be recommended.

5. If Phase I data or Tier 1 data of the Phase II RI/FS combined with Phase I data exceed PRGs, action levels, or background concentrations for the various media, then Tier 2 of the Phase II RI/FS sampling and analyses will be conducted to define horizontal and vertical extent, provided additional sampling costs are not more than a potential response action.

6. If PRGs, action levels, or background concentrations for shallow soil are exceeded, and if COPCs detected in the soil extend to 10 feet bgs, then soil below 10 feet bgs (subsurface soil) will be investigated to assess the horizontal and vertical extent of the COPCs.

7. If during the investigation of COPCs in subsurface soil, two consecutive soil sample analyses (at a minimum 5-foot-depth separation) demonstrate that COPCs are not detected, then the vertical extent of soil contamination will be established and investigation of subsurface soil will be halted at that location. The horizontal extent will be established when COPCs are not detected in vertical samples taken at three locations around the sample that exceeds the action levels.

   The lowest detection limit available will be used to define the base of a contaminant plume. COPC detection or quantitation limits that will be compared to establish the base of the contaminant plume include the following:

   - CRDL,
   - contract-required quantitation limit,
   - sample quantitation limit,
   - estimated quantitation limit,
   - practical quantitation limit,
   - method detection limit, and
   - IDL.

8. If during the investigation of COPCs in subsurface soil, it is determined by actual sampling that COPCs extend to the water table, groundwater beneath the site will be investigated for the presence of the COPCs.

9. If COPCs are identified in subsurface soil below 10 feet bgs, above background and action levels, but do not extend to the water table, then vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.

10. If it is determined that COPCs in subsurface soil have impacted groundwater causing exceedance of action levels, then the vertical and horizontal extent of groundwater exceedance will be evaluated.

13. If action levels or background concentrations are exceeded for the media of a site unit, then the risk assessment will be initiated, based on sample results, acceptable levels of risk, and potential land uses, to assess potential risks to human health and/or the environment.

14. If unacceptable risks are assessed to human health or the environment, then cleanup levels will be evaluated for each media.

15. If cleanup levels in a given medium are exceeded, and if the site meets at least one of the eight criteria for removal action described in 40 *Code of Federal Regulations* 300.415(b)(2), and the scale and complexity of contaminant distribution in the affected medium are such that excess risk can be expediently reduced utilizing readily available technology, then the medium at the site will be recommended for Early Action.

16. If an early removal action is selected, a non-time-critical EE/CA and Action Memorandum will be completed for the removal action.

17. Once the removal action is completed, the site will be evaluated for residual risk. If a residual risk exists, then a Long-Term Action may be required.

18. If cleanup levels for a given medium are exceeded, and if the site does not meet criteria for an Early Action, then the affected medium will be recommended for long-term remedial action as part of the RI/FS process; and an FS will be completed, followed by a Record of Decision, Remedial Design, and Remedial Action to clean up the site for closure.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The purpose of Step 6 is to establish limits for decision errors, which are used by the decision makers to establish performance goals for the data collection design. The objective of the data collection design is to obtain data that reliably estimate the true nature of environmental conditions at Site 6. This process is presented in Section 4 of the Work Plan and the following presents specific information on Site 6.

### Identify the Null Hypothesis and Identify the Decision Errors

The null hypothesis for this site specifies that the concentrations of one or more of the COPCs exceed PRGs or risk-based action levels and represent an unacceptable risk at the site.

The alternative hypothesis for this site specifies that the concentrations of one or more of COPCs do not exceed PRGs or risk-based actions levels and represent an acceptable risk at the site.

The false-positive and false-negative decision errors are discussed in Section 4 of the Work Plan.

### Decision Error Limits

For the Phase II RI/FS, the allowable probability of making a false positive decision has been designated as 0.05 (confidence level of 95 percent) and a probability of making a false-negative decision error has been designated as 0.20 (power level of 80 percent).

### Calculating the Number of Samples Necessary to Determine Risk

The number of sample locations necessary to determine the risk at a unit or a site were estimated using the process presented in Section 4 of the Work Plan. The number of additional sample locations needed to assess risk during the Phase II RI/FS is the difference between the total number of sample locations and the number of locations sampled during the Phase I RI (Table F-1).

### Sampling Designs for the OU-3 Sites

Two types of sampling designs will be used to determine the soil conditions at the OU-3 sites. These sampling designs are:

- stratified random sampling (either whole or partial unit areas, with replacement where sample locations are closely spaced or overlap), and
- systematic random sampling along an axis (with replacement if new and existing sample locations overlap or are closely spaced).

A description of these Phase II RI/FS sampling designs is presented in Section 4 of the Work Plan. These sampling designs utilize random positioning to produce an unbiased configuration of sample locations. The advantage of a random, unbiased sampling design is that the tolerance limits for false-positive and false-negative decision errors can be applied to the sample data and the risk decisions can be assigned a level of confidence.

## STEP 7 – OPTIMIZE THE DESIGN

Historic site activities, previous site investigation results, and regulatory comments were used to formulate the Phase II RI/FS sampling approach. Shallow and deeper subsurface soils will be investigated at this site using a tiered sampling approach. This sampling approach consists of three tiers:

- The main focus of the Tier 1 sampling plan will be to determine whether the unit is a risk. The Tier 1 sampling approach will consist of collecting shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed such that when the Phase I and II RI/FS data are evaluated together, an assessment of risk can be completed for the unit.

## Table F-1
## Summary of Phase II RI/FS OU-3 Soil Sampling Strategies

| Description | Unit Area | Estimated Risk[a] | Number of Locations/ Samples[b] | Number of Phase I Locations/ Samples | Number of Phase II Locations/ Samples | Tier | Type of Sampling Strategy |
|---|---|---|---|---|---|---|---|
| Site 6–Drop Tank Drainage No. 1 | Unit 1–1,254 ft$^2$ | $< 10^{-6}$ (0.20) | 12(36) | 4(10) | 2(6)[c] | 1 | Stratified Random: partial area |
| | Unit 2–26,970 ft$^2$ | $< 10^{-6}$ (0.31) | 12(36) | 3(6) | 3(9)[c] | 1 | Systematic Random on an Axis |
| | Unit 3–94,370 ft$^2$ | $1 \times 10^{-6}$ (3) | 12(36) | 3(7) | 3(9)[c] | 1 | Stratified Random: partial area |

Notes:

[a] These estimated cumulative cancer risk values were developed using Phase I RI data, and COPC-specific risk-based concentrations were developed following completion of Phase I RI activities. Numbers in parentheses are the estimated hazard index values.

[b] Number of samples based on comparison of estimated cancer risk to Table 4-7 in Phase II RI/FS Work Plan, which correlates four cancer-risk categories to the number of samples needed to determine that risk using the project-specific power and confidence limits. For this column, the first number represents sample locations, and the second number (in parentheses) is the number of samples based on an average of three depth intervals per sample location.

[c] These numbers represent the difference between the number of samples required to determine risk and the number of samples collected as part of the Phase I RI, with the following provisions:
Where Phase II RI/FS sample locations were recommended to determine risk, the area covered by this number of locations was based upon the U.S. EPA risk determination standard of a 40- x 40-meter block per sample location. This corresponds to an area of about 206,700 feet$^2$ for 12 sample locations. If the unit area is greater than this size limit, the maximum specified number of samples, less the Phase I RI number of samples, will be collected during the Phase II RI/FS. If the unit area is less than this size limit, the number of sample locations represents a ratio of the unit area versus the 12-sample area (206,700 feet$^2$) times 12 (e.g., Site 19, Unit 3: [Unit 3 area/206,700 feet$^2$]) x 2 locations = 9 locations needed - 3 Phase I locations = 6 new Phase II RI/FS locations required. Use of this ratio rule should maintain the necessary power and confidence limits at units where fewer samples are collected. At units where the ratio rule is applied, the total number of samples (Phase I and Phase II combined) will never be less than 6 despite the ratio calculation, to be sure that the minimum number of sample locations necessary for a risk assessment is collected. The number of Phase II RI/FS shallow soil boring locations has been based on three samples per location. However, at Site 8 (Unit 3) and Site 12 (Units 1, 2, and 4), four samples per location will be collected.

- The Tier 2 sampling approach will also focus on shallow soil; however, the primary objective will be to refine the extent of shallow soil that has been impacted by site activities, by focusing on subareas of the unit where COPCs exceeded PRGs as identified by the Tier 1 sampling and/or Phase I RI/FS results.
- The Tier 3 sampling approach has been designed to estimate the horizontal and vertical extent of impacted subsurface soil (greater than 10 feet bgs). This sampling strategy will only be implemented if Phase I RI/FS soil sample analytical data or Phase II RI/FS Tier 1/Tier 2 soil sample analytical data suggest impacted soil exists at depths greater than 10 feet bgs. Groundwater will be investigated if Phase I or Phase II soil data indicate potential impacts to groundwater are possible.

The tiered sampling approach is detailed in the following sections and in the FSP, Attachment F (BNI 1995). For a list of all soil sampling and analysis at Site 6, see Table F-2.

# Tier 1

The Tier 1 of sampling will be collection of shallow samples from each unit within the site as described below. A summary of the number of sample locations, number of samples, and sample analysis is presented in Table F-2.

## TIER 1 SOIL SAMPLING

Tier 1 sample locations within the three units will be positioned using a systematic random sampling on an axis, or a stratified random sampling design to support the assessment of risk and to characterize additional areas not sampled as part of the Phase I RI (Figure F-2).

### *Unit 1: Concrete Apron Edge*

The objectives of this investigation are to confirm Phase I RI results and to collect data in support of a risk assessment, so that a recommendation for NFI, Early Action, or Long-Term Action can be made.

During the Phase I RI, three locations were sampled in the area of Unit 1. The results of soil sample analysis indicated that lead exceeds ecological screening criteria. In the Phase II RI, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at two stratified random sample locations. All soil samples will be analyzed for polynuclear aromatic hydrocarbons (PAH) (U.S. EPA Method 8310), VOCs (U.S. EPA Method 8010), TPH (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under Naval Facilities Engineering Service Center (NFESC; formerly known as NEESA) Level D protocols. Attachment F in the FSP provides the sampling procedures for the Phase II RI/FS at Site 6, Unit 1 (BNI 1995).

## Table F-2
## Soil Sampling and Analysis

| Tier | Unit/Name | PHASE II RI/FS SAMPLE NUMBERS | | | FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY | | | | | OFF-SITE LABORATORY[b] | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. of Locations | Samples/ Location | Total Samples | PAH[c] | PCBs[c] | VOCs[d] | TPH Gas and Diesel[d] | Target Analyte List - Metals[d] | PAH | VOCs | TFH Gasoline and Diesel | TAL Metals |
| Tier 1 | Unit 1 Concrete Apron Edge | | | | | | | | | X | X | X | X |
| | Unit 2 Drainage Ditch | 12 | 3 | 36 | X | | X | X | X | | | | |
| | Unit 3 Storage Area | 12 | 3 | 36 | X | | X | X | X | | | | |
| | *Tier 1 Subtotals* | | | 36 | 36 | | 36 | 36 | 36 | | | | 72 |
| Tier 2 | Optional: Scope of Tier 2 would be to further define extent of shallow soil contamination; based on Tier 1 data, Phase I RI findings, and RFA data, with approval of BCT | | | | | | | | | | | | |
| Tier 3 | Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data, combined with the Phase I RI findings, with approval of BCT | | | | | | | | | | | | |

Notes:
[a] For QA/QC support and verification, six samples from Unit 2 and three samples from Unit 3 will be submitted to a fixed-base laboratory for field screening confirmation.
[b] These constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory.
[c] immunoassay analyses
[d] mobile laboratory analyses

### *Unit 2: Drainage Area*

The objectives of this investigation are to collect sufficient data to characterize the expanded areas, assess the possible NFI recommendation, and support the risk assessment.

During the Phase I RI three locations were sampled in the area of Unit 2. The soil sample analytical results indicate that antimony, chromium, lead, and zinc exceed ecological screening criteria.

In the Phase II RI, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at three systematic random sample locations on an axis. All soil samples will be submitted to the fixed-base laboratory for chemical analyses. These fixed-base analyses are PAH (U.S. EPA Method 8310), VOCs (U.S. EPA Method 8010), TPH (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under NFESC Level D protocols. Attachment F in the FSP provides the sampling procedures for the Phase II RI/FS at Site 6, Unit 2 (BNI 1995).

### *Unit 3: Storage Area*

The objectives of this investigation are to confirm Phase I RI results and to collect data to support a risk assessment, so that a recommendation for NFI, Early Action, or Long-Term Action can be made.

During the Phase I RI three locations were sampled in the area of Unit 3. The results of soil sample analysis indicated that lead exceeded PRGs.

In the Phase II RI, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at three stratified random sampling locations. For quality assurance/quality control support and verification, three samples (two detects and one nondetect) will be submitted to the fixed-base laboratory for chemical analyses. These fixed-base analyses are PAH (U.S. EPA Method 8310), VOCs (U.S. EPA Method 8010), TPH (U.S. EPA Method 8015M), and TAL metals (U.S. EPA Method 6000/7000) under NFESC Level D protocols. Attachment F in the FSP provides the sampling procedures for the Phase II RI/FS at Site 6, Unit 3 (BNI 1995).

## Tier 2

The primary objective of the Tier 2 sampling program is to refine the extent of impacted soil identified within each unit by Phase I and/or II RI/FS sampling results. The Tier 2 sampling program will focus exclusively on shallow soil (0 to 10 feet depth) conditions and will further investigate subareas within the unit boundary that exceed PRGs.

The Tier 2 sampling plan will be developed after an evaluation of Phase I RI/FS and/or Phase II RI Tier 1 analytical results. If a Tier 2 sampling program meets the DQOs for this unit, the decision to proceed will be based upon the criteria described in DQO Steps 2, 3, and 5. The proposed Tier 2 sampling plan, with recommendations, will be reviewed by the Base Realignment and Closure (BRAC) Cleanup Team (BCT). The BCT will decide whether the proposed Tier 2 sampling program will be implemented by the Navy.

## TIER 2 SOIL SAMPLING

As noted, the objective of a Tier 2 sampling program is to refine the extent of impacted shallow soil within the unit being investigated. The rationale for accomplishing this objective depends primarily on the size and layout of the unit. Where the unit is a linear feature, such as a drainage ditch, the Tier 2 program will focus sampling along the trend of the ditch bracketing the Tier 1 sampling locations (or Phase I RI/FS sample locations) where analyte concentrations exceeding PRGs are reported.

For units of rectangular, roughly circular, or irregular dimensions, a systematic random sampling based on a grid, stratified random sampling, or judgmental sampling approach will be used to define the extent of the Tier 1 sample location(s) where analyte concentrations exceeded PRGs. The limits of the area covered by these sampling approaches will be contingent upon the distribution of adjacent Tier 1 sample locations in which the COPCs were not detected.

The number of Tier 2 sampling locations (i.e., grid spacing) will be selected to achieve the following objectives:

- provide the areal coverage necessary to define the extent of shallow impacted soil, and
- minimize the cost associated with field and fixed-base laboratory sample testing.

The spacing between sampling locations for Tier 2 will be contingent upon the estimated size of the area to be investigated and the spacing between Phase I or II RI/FS sample locations. Tier 2 soil sample depth intervals and chemical analyses will conform to those specified for Tier 1 soil sampling.

## Tier 3

The Tier 3 sampling program would only be implemented at a unit where Phase I RI data, or the initial evaluation of the Phase II RI Tier 1 and/or Tier 2 sampling program results suggest that soil contamination may extend to depths greater than 10 feet bgs.

The objectives of the Tier 3 sampling program are to estimate the horizontal and vertical extent of impacted subsurface soil (greater than 10 feet bgs) and assess whether groundwater beneath the site has been impacted by historic site activities. If impacted subsurface soil is limited to the vadose zone above the water table or vadose zone modeling does not suggest a potential for COPCs to impact groundwater, then groundwater quality will not be investigated.

The Tier 3 sampling plan will be developed after an evaluation of Phase I RI/FS and Phase II RI Tier 1 and/or 2 analytical results. If a Tier 3 sampling program meets the DQO for this unit, then the decision to proceed will be based upon the criteria described in DQO Steps 2, 3, and 5. The proposed Tier 3 sampling plan, with recommendations, will be reviewed by the BCT. The BCT will decide whether the proposed Tier 3 sampling program will be implemented.

## Optimization of Sampling Plan

As soil analytical data become available from sampling in each unit, investigative plans for the site will be optimized. The proposed tiered sampling approach is an iterative process, that will permit data from one tier to be evaluated prior to the implementation of the next tier of sampling. The iterative process involves review of data, recommendations for further actions, and approval of the BCT. In this way, the investigation can be optimized by performing the least amount of sampling necessary to assist the decision-making process about future actions at the unit (i.e., NFI, Early Action, and Long-Term Action).

# References

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# WORK PLAN APPENDIX G

## DATA QUALITY OBJECTIVES
## OPERABLE UNIT 3 –
## SITE 7 – DROP TANK DRAINAGE AREA NO. 2

# SUMMARY

## STEP 1 – STATE THE PROBLEM

Site 7, the Drop Tank Drainage Area No. 2, comprises several grassy areas adjacent to an aircraft parking apron where residual fuel was emptied from aircraft drop tanks during cleaning. The mixture of residual fuel and wash water drained from the concrete apron onto the adjacent grassy areas and has impacted soil in that area. Soil at this site has also been impacted by spraying of lubrication oil and other waste fluids for dust control. The human health and ecological risks associated with the impacted soil will be estimated so that a No Further Investigation or the appropriate remedial alternative can be recommended.

## STEP 2 – IDENTIFY THE DECISION

The Phase II Remedial Investigation/Feasibility Study decisions to be considered at Site 7 are as follows: Do chemicals of potential concern in the shallow soil at Site 7 present an unacceptable risk to human health and the environment? Are the chemicals of potential concern present in the subsurface soil (greater than 10 feet below ground surface), and if so, do they present an unacceptable risk to groundwater? The possible decision outcomes are recommendations for No Further Investigation, Early Action, or Long-Term Action.

## STEP 3 – IDENTIFY THE INPUTS AFFECTING THE DECISION

Inputs necessary to make these decisions include a list of chemicals of potential concern; the extent of impacted media; the background (ambient) concentrations of metals, herbicides, and pesticides; and the action levels for protection of human health and the environment.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

The study is limited to the geographic area of Site 7, which comprises five subareas: 1) the North Pavement Edge (approximately 15,000 square feet) presently a Removal Action unit; 2) the Old East Pavement Edge (approximately 42,750 square feet) presently a No Further Investigation unit; 3) the New East Pavement Edge (approximately 27,300 square feet) presently a Removal Action unit; 4) the Drainage Ditch (approximately 27,950 square feet); and 5) the Open Dirt Area south of Building 296 (approximately 90,500 square feet).

## STEP 5 – DEVELOP A DECISION RULE

Action levels developed for decision-making purposes are a cumulative excess cancer risk of $10^{-6}$ in humans and a hazard index of 1.0 for chronic systemic toxicity in humans. Based on these risk levels, decision rules have been formulated to protect human health and the environment in residential, recreational, and industrial land use scenarios.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The number of samples necessary to estimate different levels of risk were calculated using the confidence level of 95 percent and power level of 80 percent limits specified for this project. The preliminary cancer and noncancer risk values were compared to the risk levels, and the appropriate number of samples necessary to estimate risk were selected for each unit.

## STEP 7 – OPTIMIZE THE DESIGN

Shallow soil samples will be collected and analyzed at 0, 5, and 10 feet below ground surface in 1) three locations in the Drainage Ditch (Unit 4); and 2) two locations in the Open Dirt Area south of Building 296 (Unit 5) to assess soil impacted by site operations in these areas.

# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| AOC | area of concern |
| ARAR | applicable or relevant and appropriate requirement |
| BCT | BRAC Cleanup Team |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure |
| CFR | *Code of Federal Regulations* |
| COPC | chemical of potential concern |
| CRDL | contract-required detection limit |
| DDD | dichlorodiphenyldichloroethane |
| DDE | dichlorodiphenyldichloroethene |
| DDT | dichlorodiphenyltrichloroethane |
| DQO | data quality objective |
| EE/CA | Engineering Evaluation/Cost Analysis |
| FSP | Field Sampling Plan |
| IDL | instrument detection limit |
| LUFT | (California) Leaking Underground Fuel Tank (Field Manual) |
| MCAS | Marine Corps Air Station |
| μg/kg | micrograms per kilogram |
| μg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| NEESA | Naval Energy and Environmental Support Activity |
| NFESC | Naval Facilities Engineering Service Center |
| NFI | No Further Investigation |
| PAH | polynuclear aromatic hydrocarbons |
| PCB | polychlorinated biphenyl |
| pCi/L | picocuries per liter |
| PRG | (U.S. EPA Region IX) Preliminary Remediation Goal |
| QA/QC | quality assurance/quality control |

## ACRONYMS/ABBREVIATIONS (continued)

| | |
|---|---|
| RA | remedial action |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA Facility Assessment |
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| SWMU | solid waste management unit |
| SVOC | semivolatile organic compound |
| TAL | target analyte list |
| TDS | total dissolved solids |
| TFH | total fuel hydrocarbons |
| TRPH | total recoverable petroleum hydrocarbons |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |

## Appendix G
# SITE 7 – DROP TANK DRAINAGE AREA NO. 2

The United States Environmental Protection Agency (U.S. EPA) developed the data quality objectives (DQO) process as a tool for project managers to determine the type, quantity, and quality of data needed to make decisions. Data produced by sampling and monitoring activities are used extensively in problem definition, rule-making, and enforcement decisions. These activities are supported through implementation of the mandatory U.S. EPA Quality System, which requires all organizations to develop and operate management processes and structures for assuring that the data collected are of the needed and expected quality for their desired use (U.S. EPA 1993).

The U.S. EPA DQO process consists of the following seven steps.

1. **State the problem:** Describe the problem at the site as it is currently understood. The problem statement includes a site conceptual model and an organization and review of all relevant data.
2. **Identify the decision:** Determine an if-then statement that will define what the investigation will seek to determine and what actions will be taken based on the possible outcomes of the investigation.
3. **Identify inputs into the decision:** Specify the analytes or parameters to be measured and used.
4. **Define the study boundary:** Delineate the study boundary from information obtained from Step 1.
5. **Develop a decision rule:** Restate the decision detailing the if-then statement in specific terms.
6. **Specify acceptable limits on decision errors:** Specify how the data will be treated statistically and what the acceptable limits of uncertainty are.
7. **Optimize the design:** Design the field investigation, giving adequate consideration to the results of Steps 5 and 6. This step is described in more detail in the Field Sampling Plan (FSP).

The following sections describe the DQO process for Site 7 – Drop Tank Drainage Area No. 2.

## STEP 1 – STATE THE PROBLEM

Site 7 comprises several grassy areas adjacent to an aircraft parking apron where residual fuel was emptied from aircraft drop tanks and the tanks were cleaned. The mixture of residual jet fuel and wash water drained form the concrete apron onto the adjacent grassy areas and has impacted soil in that area. Soil at this site has also been impacted by spraying of lubrication and other waste fluids for dust control.

### Site Description

Site 7, the Drop Tank Drainage Area No. 2, is located in the southwest quadrant of Marine Corps Air Station (MCAS) El Toro, north and west of Buildings 295 and 296 at an elevation of approximately 275 feet mean sea level (Figure G-1). Site 7 comprises five areas: 1) north pavement edge; 2) old east pavement edge; 3) new east pavement edge; 4) drainage ditch; and 5) open dirt area south of Building 296 (Figure G-2). Site boundaries for MCAS El Toro Phase I Remedial Investigation (RI) were determined by consensus between the Navy and the regulatory agencies prior to initiation of the Phase I RI. Areas of concern (AOCs) were generally grouped together as sites based on common historical activities, aerial photograph review, and their respective locations to each other.

Site 7 was previously used for aircraft drop tank storage and drainage. In the north area, aircraft drop tanks were drained and washed from approximately 1969 to 1983. An estimated 7,000 gallons of JP-5 and lubrication oil were disposed in this area. In the east area, the hangars may have been sprayed with over 11,000 gallons of lubrication oil and nearly 4,000 gallons of JP-5 for dust control between 1972 and 1983. From 1972 to 1978, portions of this area served as an unpaved parking lot. Lubricant oils were sprayed for dust control in the parking area. The concrete pad on the site, located west of Buildings 295 and 296, was constructed in 1979 (Jacobs Engineering 1993a). In 1982, 2,000 gallons of JP-5 were accidentally spilled in this area from a tank truck and were washed onto the soil at the edge of the pad. Surface drainage in this area is generally to the south towards Aqua Chinon Wash (Jacobs Engineering 1993a).

## Previous Investigations

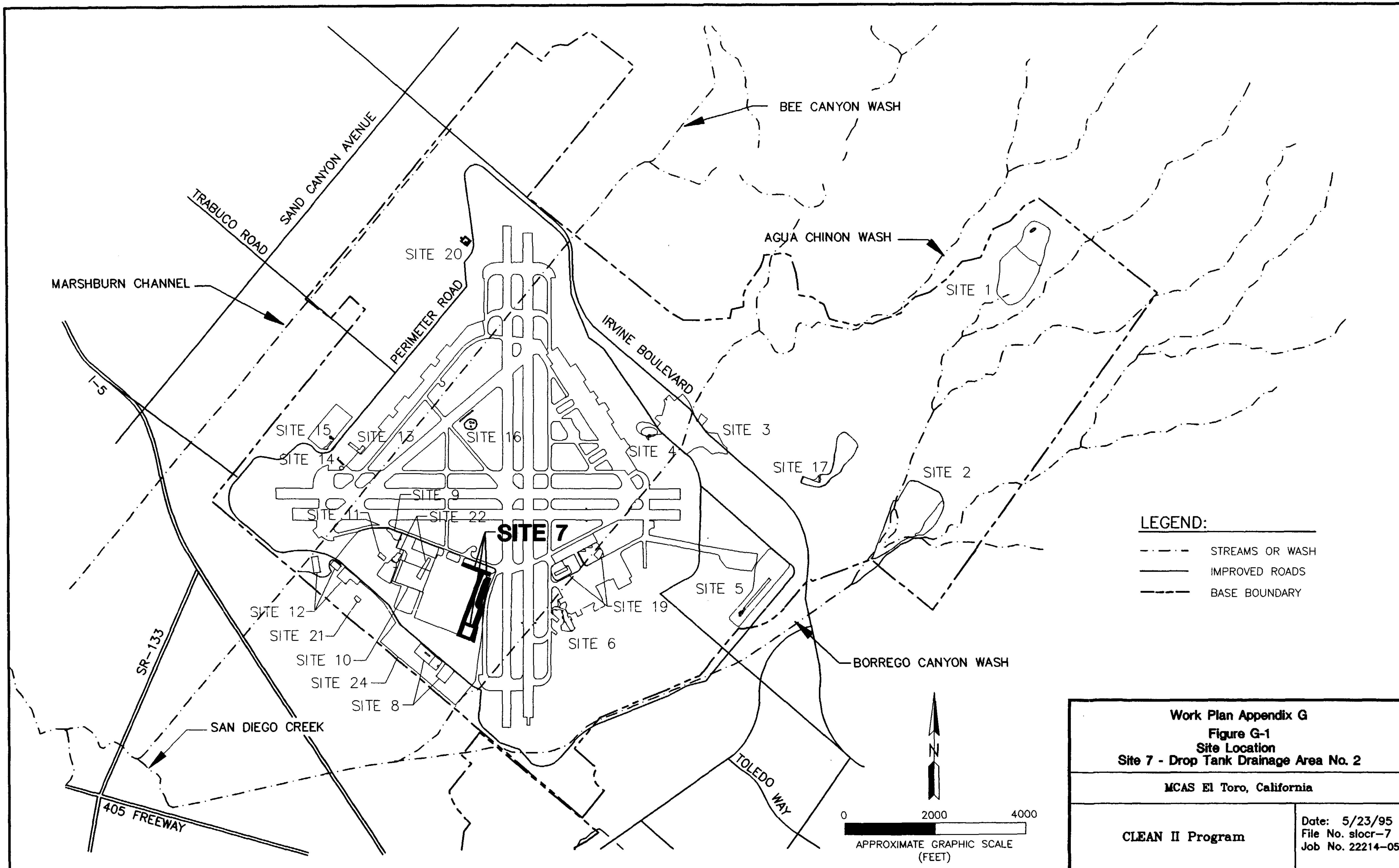
Several investigations have been conducted at Site 7, including the Resource Conservation and Recovery Act (RCRA) Facility Assessment (RFA), the Phase I RI, the aerial photographic surveys, a soil gas survey, and the employee interviews. The sections below provide a summary of these investigations.

### RCRA FACILITIES ASSESSMENT

During the RFA, solid waste management units (SWMUs)/AOCs 71 and 72 were identified within Site 7 boundaries (Jacobs Engineering 1993b). These SWMU/AOCs located within Site 7 boundaries were not investigated during the RFA. SWMU/AOC 72 is located adjacent to the northeast corner of Site 7 Unit 5. The exact location of SWMU/AOC 71 is not known; however, it is believed to be in the vicinity of Site 7 Unit 1. Both SWMU/AOCs will be evaluated during the Phase II RI/Feasibility Study (FS) field activities and limited sampling may be conducted as part of this investigation. There are no indications that suggest any releases have occurred at either of these locations. Therefore, investigations of these SWMU/AOCs may be limited to an RFA-type inspection (Jacobs Engineering 1993a) unless evidence of a release at either location is identified during the inspection.

### PHASE I REMEDIAL INVESTIGATION

For the Phase I RI, subareas within sites were designated as strata. Due to the fact that some new subareas have been added or subareas have been expanded or diminished for the Phase II RI/FS, subareas within sites will be referred to as units for the Phase II RI/FS. In this section, discussion is related to Phase I RI sampling and results and the term strata will be used. Following this section, the term unit will be used.




**Work Plan Appendix G**

**Figure G-1**
**Site Location**
**Site 7 - Drop Tank Drainage Area No. 2**

**MCAS El Toro, California**

**CLEAN II Program**

Date: 5/23/95
File No. slocr-7
Job No. 22214-059

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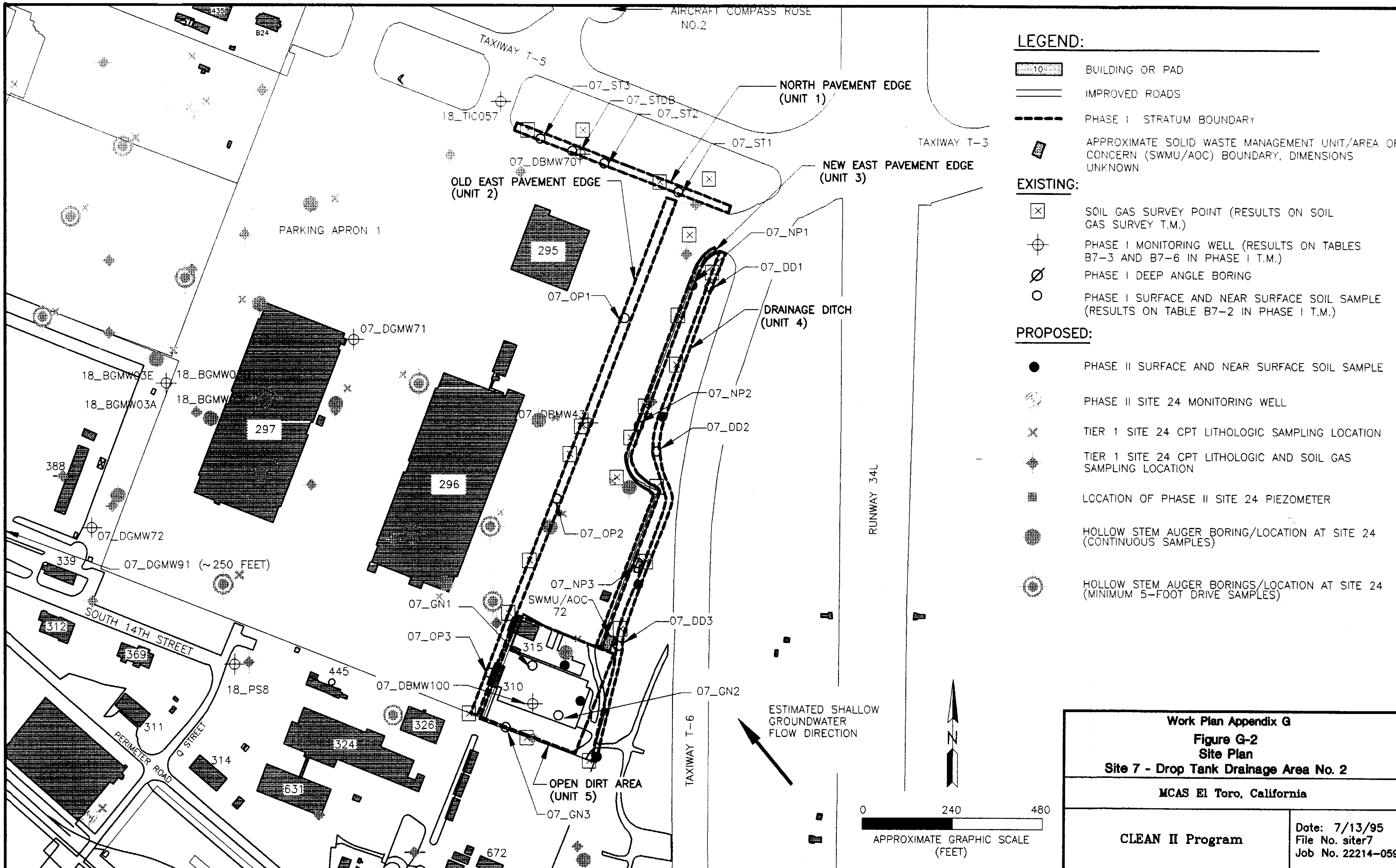


**Work Plan Appendix G**

**Figure G-2**
**Site Plan**
**Site 7 - Drop Tank Drainage Area No. 2**

**MCAS El Toro, California**

**CLEAN II Program**

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Job No. 22214-059

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For the Phase I RI, Site 7 was represented by five strata:

- Stratum 1 – the North Pavement Edge;
- Stratum 2 – the Old East Pavement Edge;
- Stratum 3 – the New East Pavement Edge;
- Stratum 4 – the Drainage Ditch; and
- Stratum 5 – the Open Dirt Area south of Building 296.

Strata 1, 2, and 3 are all current or former edges of the concrete apron that surround Buildings 295 and 296. Stratum 4 is a drainage ditch that had the potential to receive runoff generated from drop tank activities on the concrete apron areas. Stratum 5 is a storage area that has been active since at least 1952.

The following site-specific activities were conducted during the Phase I RI:

- the collection of shallow soil samples (0 to 10 feet below ground surface [bgs]) from 16 locations in Strata 1 through 5;
- the drilling and sampling of three deep borings;
- the drilling, installation, and sampling of three downgradient monitoring wells;
- the analysis of soil samples for metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), total fuel hydrocarbons (TFH), total recoverable petroleum hydrocarbons (TRPH), pesticides/polychlorinated biphenyls (PCBs); and
- the analysis of groundwater samples for metals, general chemistry VOCs, SVOCs, TFH, TRPH, pesticides/PCBs, herbicides, and gross alpha/beta.

A summary of the ranges of analyte concentrations detected during the Phase I RI (sample identification of the highest concentration is provided) plus recent groundwater monitoring data are presented below. All chemicals of potential concern (COPCs) that were detected in soil are listed with the exception of specific metals which are listed only if U.S. EPA Region IX Preliminary Remediation Goals (PRGs) or ecological screening criteria in shallow soil were exceeded. All COPCs exceeding PRGs or maximum contaminant levels (MCLs) in groundwater are included in this list. If a minimum concentration is recorded with a "less than" symbol, it denotes a concentration below the contract laboratory program detection limit. Sample locations are shown on Figure G-2. A complete listing of all detected chemicals is presented in the Phase I RI Technical Memorandum, Appendix B-7, Tables B7-2 through B7-7 (Jacobs Engineering 1993b), and in the Groundwater Quality Data Report (Jacobs Engineering 1994a). Target analyte list metals that were analyzed during the Phase I RI are beryllium, barium, arsenic, antimony, aluminum, cadmium, calcium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

### *Shallow Soil (less than 10 feet below ground surface)*

- metals: barium (0.24 to 729 milligrams per kilogram [mg/kg] [07_NP2 at 0 feet]), cobalt (1.2b to 31.2 mg/kg [07_OP1 at 0 feet]), lead (0.01 to 931 mg/kg [07_GN1 at 0 feet]), mercury (< 0.03 to 0.51 mg/kg [07_GN3 at 2 feet]), and 17 other TAL metals;
- VOCs: acetone (< 10 to 64B micrograms per kilogram [μg/kg] [07_GN1 at 0 feet]), benzene (< 10 to 9J μg/kg [07_ST2 at 0 feet]), carbon tetrachloride (< 10 to 2J μg/kg [07_ST1 at 0 feet]), methylene chloride (< 6 to 14 μg/kg [07_ST2 at 2 feet]), xylenes (< 10 to 3J μg/kg [07_GN3 at 0 feet]);
- SVOCs: benzo(a)anthracene (< 670 to 1,300 μg/kg [07_NP1 at 0 feet]), benzo(a)pyrene (< 670 to 1,800 μg/kg [07_NP1 at 0 feet]), benzo(b)fluoranthene (< 670 to 2,800 μg/kg [07_NP1 at 0 feet]), benzo(g,h,i)perylene(< 670 to 6,900 μg/kg [07_GN1 at 0 feet]), benzo(k)fluoranthene (< 670 to 1,300 μg/kg [07_STDB at 0 feet]), bis(2-ethylhexyl) phthalate (< 670 to 1,400 μg/kg [07_GN1 at 0 feet]), carbazole (< 670 to 460J μg/kg [07_NP1 at 0 feet]), chrysene (< 670 to 2,400 μg/kg [07_NP1 at 0 feet]), dibenzo(a,h)anthracene (< 670 to 410J μg/kg [07_NP1 at 0 feet]), diethyl phthalate (< 670 to 240J μg/kg [07_GN2 at 2 feet]), fluoranthene(< 670 to 4,100 μg/kg [07_NP1 at 0 feet]), indeno(1,2,3-cd)pyrene (< 670 to 1,500 μg/kg [07-NP1 at 0 feet]), phenanthrene (< 670 to 1,400 μg/kg [07_STDB at 0 feet]), pyrene (< 670 to 3,400 μg/kg [07_NP1 at 0 feet]);
- pesticides and PCBs: 4,4'-dichlorodiphenyldichloroethane (DDD) (< 3.34 to 163 μg/kg [07_ST1 at 0 feet]), 4,4'-dichlorodiphenyldichloroethene (DDE) (< 3.34 to 38.7 μg/kg [07_ST1 at 0 feet]), 4,4'-dichlorodiphenyltrichloroethane (DDT) (< 3.34 to 200 μg/kg[ 07_ST1 at 0 feet]), dieldrin (< 3.34 to 25.3 μg/kg [07_GN1 at 0 feet]), endosulfan sulfate (< 3.41 to 66.9 μg/kg [07_GN1 at 0 feet]), endrin (< 3.34 to 6.54 μg/kg [07_GN1 at 0 feet]), endrin ketone (< 3.34 to 2.1 μg/kg [07_NP2 at 2 feet]); and
- fuel and petroleum hydrocarbons: TFH-diesel (< 12.6 to 686 mg/kg [07_ST2 at 0 feet]), TFH-gasoline (< 0.051 to 2.68 mg/kg [07_ST2 at 0 feet]), TRPH (< 20 to 32,091 mg/kg [07_GN1 at 0 feet]).

### *Subsurface Soil (greater than 10 feet below ground surface)*

- metals: 22 of 23 TAL metals;
- VOCs: 1,1-dichloroethene (< 10 to 3J μg/kg [07_DGMW71 at 110 feet]), 2-butanone (< 10 to 4J μg/kg [07_DBMW70 at 60 feet]), acetone (< 10 to 74 μg/kg [07_DBMW43 at 5 feet]), methylene chloride (< 10 to 10JB μg/kg [07_DBMW70 at 100 feet]), trichloroethylene (< 10 to 74 μg/kg [07_DGMW71 at 100 feet]), toluene (3J μg/kg [07_DBMW70 at 100 feet]);
- SVOCs: benzyl butyl phthalate (< 680 to 1,100 μg/kg [07_DBMW70 at 60 feet]); and
- fuel and petroleum hydrocarbons: TFH-gasoline (< 0.052 to 0.233 mg/kg [07_DBMW43 at 5 feet]), TRPH (< 20 to 138 mg/kg [07_DBMW43 at 15 feet]).

***Groundwater (07_DBMW43, 70 and 100 on-site)***

- general chemistry: chloride (172 to 272 milligrams per liter [mg/L] [07_DBMW43]), nitrate/nitrite-N (9.37 to 18.5 mg/L [07_DBMW70]), sulfate (116 to 319 mg/L [07_DBMW70]), total dissolved solids (TDS) (880 to 1,220 mg/L [07_DBMW43]);
- metals: antimony (< 0.9 to 18.4B micrograms per liter [µg/L] [07_DBMW70]), arsenic (< 0.7 to 0.8 µg/L [07_DBMW100]), beryllium (< 0.5 to 0.64B µg/L [07_DBMW100]), manganese (8.9B to 90.8 µg/L [07_DBMW43]), nickel (93.8 to 615 µg/L [07_DBMW43), selenium (< 0.7 to 33.8 µg/L [07_DBMW70]), and 14 other TAL metals;
- VOCs: carbon tetrachloride (< 1 to 4 µg/L [07_DBMW70]); and
- fuel and petroleum hydrocarbons: TFH-diesel (< 250 to 2,660 µg/L [07_DBMW70]), TFH-gasoline (< 50 to 467J µg/L [07_DBMW70]).

***Groundwater (07_DGMW71, 72, and 91 downgradient)***

- general chemistry: nitrate/nitrite-N (13.1 to 17.7 mg/L [07_DGMW91]), sulfate (112 to 769 mg/L [07_DGMW72]), TDS (913 to 1,860 mg/L [07_DGMW72]);
- metals: arsenic (< 0.7 to 2.1B µg/L [07_DGMW72]), antimony (< 12.1 to 26.7B µg/L [07_DGMW72), cadmium (< 0.7 to 10.2 µg/L [07_DGMW91]), nickel (11.6B to 567 µg/L [07_DGMW91]), selenium (< 10.9 to 79.4 µg/L [07_DGMW72), and 14 other TAL metals;
- VOCs: 1,1-dichloroethene (< 1 to 0.7J µg/L [07_DGMW71), carbon tetrachloride (< 1 to 4 µg/L [07_DGMW72]), chloroform (< 1 to 4 µg/L [07_DGMW72]), tetrachloroethene (< 1 to 4 µg/L [07_DGMW91]), trichloroethylene (< 2 to 120d µg/L [07_DGMW72]);
- fuel and petroleum hydrocarbons: TFH-gasoline (< 250 to 70.3J µg/L [07_DGMW72]); and
- gross alpha and beta: gross alpha (6.3 picocuries per liter [pCi/L] [[07_DGMW71]), gross beta (11.7 pCi/L [07_DGMW71]).

* = Indicates analysis only conducted for one sampling event.

J = Indicates an estimated value for qualitative use only (organic parameters).

B = Indicates reported value is less than the contract-required detection limit (CRDL), but greater than or equal to the instrument detection limit (IDL) (inorganic parameters).

PRGs and ecological screening criteria for the site were compared with corresponding soil sample analytical results. The results of this comparison for shallow soil are listed below (Jacobs Engineering 1993c, Table A7-3a):

- dibenzo(a,h)anthracene, indeno(1,2,3-cd)pyrene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, benzo(b)fluoranthene exceed PRGs, and benzo(a)pyrene, DDE, barium and lead exceed ecological screening criteria in Stratum 1;
- no COPCs exceeded PRGs, and only cobalt exceeds ecological screening criteria in Stratum 2;
- dibenzo(a,h) anthracene, indeno(1,2,3-cd)pyrene, benzo(a)anthracene, benzo(a)pyrene, benzo(k)fluoranthene, benzo(b)fluoranthene exceed PRGs, and benzo(a)pyrene, barium, and lead exceed ecological screening criteria in Stratum 3;
- no COPCs exceed PRGs, and only lead exceed ecological screening criteria in Stratum 4; and
- benzo(a)pyrene, lead, and dieldrin exceed PRGs, and benzo(a)pyrene, mercury, and lead exceed ecological screening criteria in Stratum 5.

Based on California Leaking Underground Fuel Tank (LUFT) Field Manual guidelines (LUFT 1989), petroleum hydrocarbons detected in shallow soil at Site 7 do not appear to pose a threat to groundwater.

PRGs and MCLs were compared with groundwater sample analytical results from the monitoring wells constructed as part of the investigation of Site 7 (07_DBMW43, 70, and 100 and 07_DGMW71, 72, and 91) (Jacobs Engineering 1993c, Table A7-3b). The results of this comparison are listed below:

- carbon tetrachloride and nitrate/nitrite-N exceeded PRGs and manganese, nitrate/nitrite-N, selenium, TDS exceed MCLs in the on-site well 07_DBMW43;
- carbon tetrachloride, nitrate/nitrite-N, antimony, and selenium exceed PRGs and carbon tetrachloride, chloride, nitrate/nitrite-N, selenium, sulfate, and TDS exceeded MCLs in the on-site well 07_DBMW70;
- carbon tetrachloride, arsenic, selenium, and beryllium exceed PRGs and carbon tetrachloride, antimony, nickel, nitrate/nitrite-N, selenium, TDS exceeded MCLs in the on-site well 07_DBMW100;
- 1,1-dichloroethene, trichloroethylene, arsenic, and nitrate/nitrite-N exceed PRGs and trichloroethylene, selenium, nitrate/nitrite-N, and TDS exceed MCLs in the downgradient well 07_DBMW71;
- carbon tetrachloride, tetrachloroethene, trichloroethylene, antimony, and nitrate/nitrite-N exceed PRGs and carbon tetrachloride, trichloroethylene, antimony, nitrate/nitrite-N, sulfate, and TDS exceed MCLs in the downgradient well 07_DBMW72; and
- carbon tetrachloride, tetrachloroethene, trichloroethylene, antimony, and nitrate/nitrite-N exceed PRGs and carbon tetrachloride, trichloroethylene, antimony, cadmium, nickel, nitrate/nitrite-N, and TDS exceed MCLs in the downgradient well 07_DBMW91.

## U.S. EPA AERIAL PHOTOGRAPH SURVEY

The U.S. EPA Aerial Photograph Survey indicated vertical tanks, open storage areas, and staining features within Site 7 on photographs for 1970. In the 1980 photograph, the concrete apron east of Buildings 296 and 297 had been extended farther east, which moved the drainage area to the new concrete apron edge. Staining and an easterly flow of liquid were present in most aerial photographs for Site 7 (Jacobs Engineering 1993c).

## SCIENCE APPLICATIONS INTERNATIONAL CORPORATION AERIAL PHOTOGRAPHS SURVEY

SAIC survey noted that the extension of the concrete apron east of Building 296 and 297 was completed between 1971 and 1973. Stains caused by liquids flowing easterly from the concrete apron were observed in 1946, 1961, and 1981 photographs (SAIC 1993).

## EMPLOYEE INTERVIEWS

On 26 May 1994, a meeting was held at MCAS El Toro to interview active and retired personnel from the Station Fuel Operations Division and Facility Management Department (currently the Installations Department) with extensive knowledge of Station operations and procedures for storage/disposal of hazardous materials and waste. Participating as interviewers during the meeting were agency personnel, Navy and Station personnel, and personnel from the contractors for the Navy and the U.S. EPA. During these interviews, the following information pertaining to the Drop Tank Drainage Area No. 2 (Site 7) was obtained (Jacobs Engineering 1994b).

- A 500-gallon bowser was observed near the hazardous waste storage area. Mobile bowser tanks were commonly used throughout the Station to store waste oils collected from maintenance activities. A common practice was to spread the waste oil collected in these tanks onto unpaved areas of the Station for dust control.
- It is possible that some of these bowsers have been misinterpreted as vertical tanks in the SAIC aerial photo report.
- Various types of equipment and chemical waste were stored in the areas east of Site 7. Some of the equipment included paint lockers, compressors, and pilot seat ejection charges. The types of chemicals included waste solvents and oils, and flammable materials.

## SOIL GAS SURVEY

In 1994, a soil gas survey was conducted at Sites 24 and 25, located in the southwest quadrant of the MCAS El Toro (Jacobs Engineering 1994c). The sources of the regional VOC groundwater plume are believed to be located in this area of the Station. During this investigation, both soil gas and soil samples were collected from approximately 15 and 30 feet bgs in 465 locations. Soil gas samples were analyzed for VOCs, TFH, and benzene, toluene, ethylbenzene, and xylenes; the soil samples were analyzed for VOCs.

During this investigation, approximately 20 sampling locations were positioned within and adjacent to Site 7 boundaries. The results of the soil gas samples collected from these locations indicated the presence of trichloroethylene, tetrachloroethylene, Freon-113, and carbon tetrachloride. The VOCs detected within the Site 7 boundaries will be investigated and evaluated as part of the VOC source investigation at Site 24 (Jacobs Engineering 1994c).

## Geology

The geology of Site 7 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993b). Holocene deposits consist of fine-grained overbank deposits and coarse-grained stream channel deposits. These soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene. The Miocene to late Pliocene formations are considered to be bedrock in the area.

Based on a review of boring logs from the Phase I RI, the subsurface lithology at Site 7 consists of well-graded to silty sand, interbedded with silt and clay. Within the sand units are occasional gravel lenses that are probably associated with stream channel deposits.

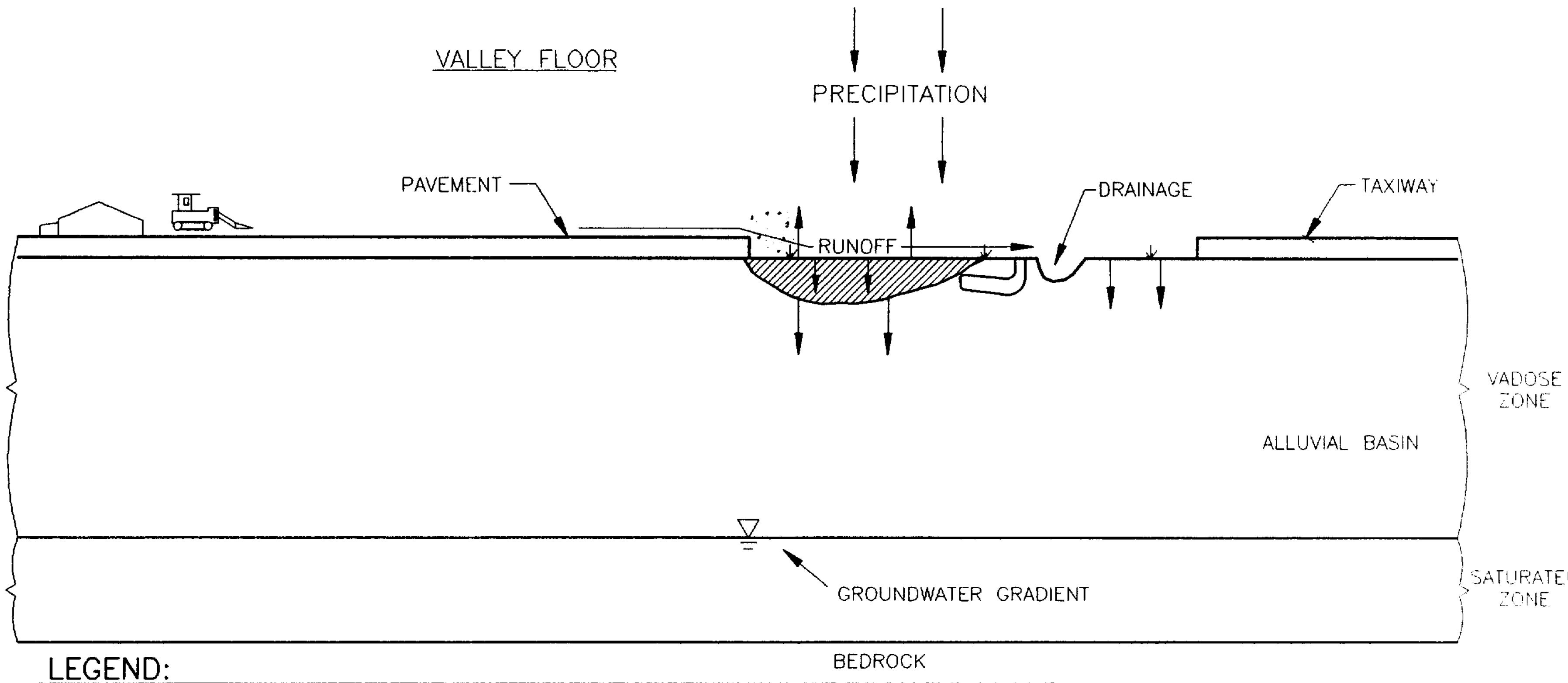
## Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Basin, a subbasin of the Los Angeles groundwater basin. Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993b).

The Phase I RI results indicate that the shallow, perched zone is absent at Site 7. The principal aquifer, located at a depth of approximately 120 feet, is the main water-producing zone for the Irvine area. The regional groundwater flow direction beneath the site is generally to the northwest. The hydraulic gradient has been influenced strongly by the pumping of irrigation wells located west of MCAS El Toro.

## Conceptual Site Model

In the process of developing a conceptual site model, release mechanisms and potential sources of contamination were considered and evaluated to determine their applicability to the site. Also considered in the development of the conceptual site model were potential receptors and contaminant pathways to potential receptors. Figure G-3 illustrates the conceptual site model developed for the site. Figure G-4 depicts the potential exposure routes and pathways for human and ecological receptors.




## LEGEND:

### RECEPTORS:

- BURROWING ANIMALS
- WORKERS
- RESIDENCES
- GRASS, BRUSH HABITATS
- TREE
- CONTAMINATED SOIL
- BASE BUILDINGS

### PATHWAYS:

- INFILTRATION
- GROUNDWATER
- WASTES
- VAPOR EMISSIONS
- LIGHT NONAQUEOUS PHASE LIQUID CONTAMINANTS
- LEACHING
- DISSOLVED PHASE CONTAMINANTS
- DUST
- UNEXPLODED ORDNANCE

NOT TO SCALE

**Work Plan Appendix G**

**Figure G-3**

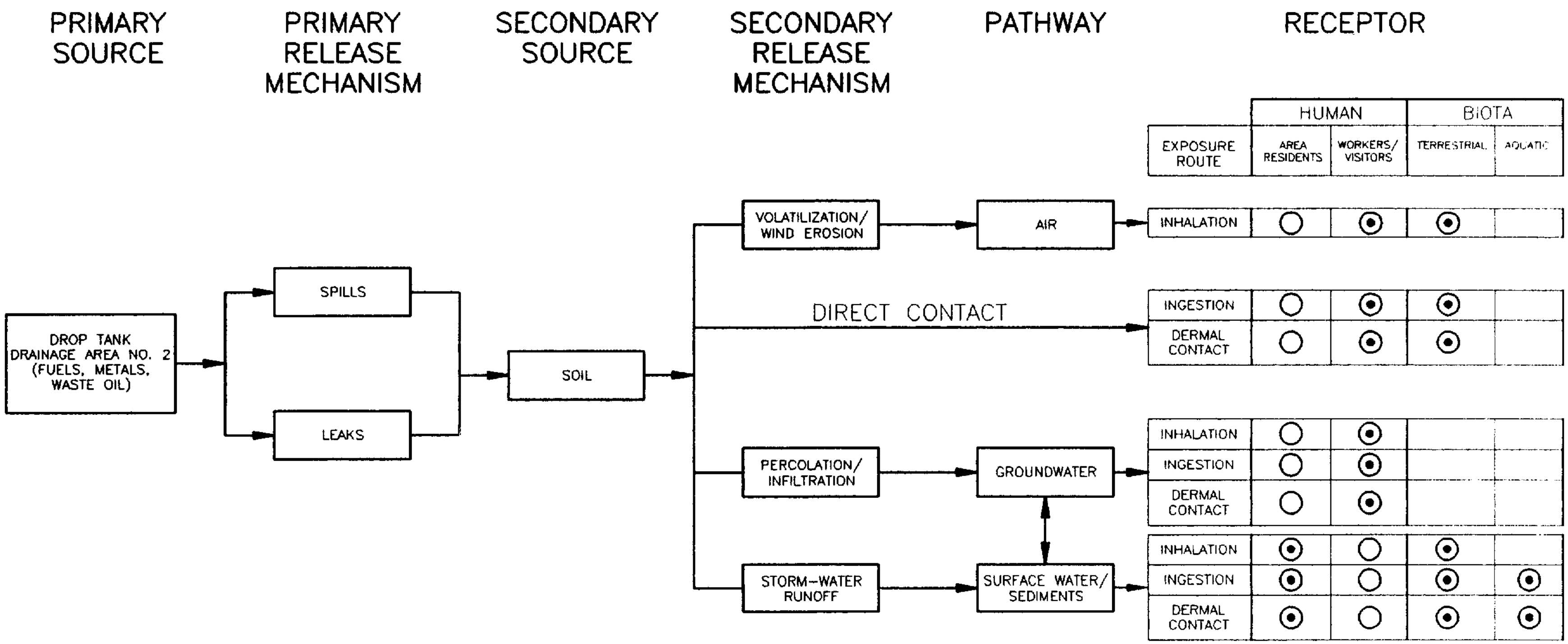
**Conceptual Site Model**

**Site 7 - Drop Tank Drainage Area No. 2**

MCAS El Toro, California

CLEAN II Program

Date: 7/3/95
File No. model-7
Job No. 22214-059




LEGEND:

● CURRENT POTENTIAL RECEPTOR

○ FUTURE POTENTIAL RECEPTOR

**Work Plan Appendix G**

## Figure G-4

**Exposure Routes and Receptors**
**Site 7 - Drop Tank Drainage Area No. 2**

**MCAS El Toro, California**

CLEAN II Program

Date: 6/28/95
File No. mod7
Job No. 22214-059

The primary release mechanism is contaminants released to shallow soil from disposal activities at this site. Eventually under gravity, contaminants present in shallow soil may move downward with soil moisture (in dissolved phase) or in a liquid phase. The depth of groundwater is recorded to be about 109 feet bgs.

The secondary source of contaminants is the surrounding soil impacted by disposal activities. The secondary release mechanism is the dust brought into suspension in the air. The fine particles of dust may contain all potential contaminants. Storm water runoff may form another secondary release mechanism. Storm water carries contaminants in dissolved forms, colloidal forms, or associated with suspended soil particles.

The potential pathways are air, groundwater, and surface water. Airborne contaminants are transported through fugitive dust and volatilization. The transport through air is affected by wind speed and direction, type of contaminant, and weather conditions. Typical wind condition at MCAS El Toro is from west/southwest at less than 10 knots. Transportation of airborne contaminants through volatilization is expected to be unimportant at this site. Surface water transport is affected by the amount of rainfall, type of contaminant, surface soil properties, and the topography of the area. The mean annual rainfall at MCAS El Toro is about 14.0 inches, most of it occurs from November through April.

Current and/or potential receptors of chemicals at this site via inhalation are workers and visitors involved in disposal activities in addition to plants and animals. Direct contact with surface and subsurface soils is currently possible via dermal or ingestion exposures of terrestrials. Infiltration of contaminated water through the vadose zone into groundwater is possible because subsurface soil is mainly sands, with some silts and clays. However, current exposure of workers is unlikely via ingestion of groundwater at this site.

Terrestrial wildlife could be exposed to chemicals in on-site surface soil, and dust and vapors through ingestion, dermal absorption or inhalation. Terrestrial plants could also be exposed through root absorption of chemicals in surface soil or deposition of dusts. No special-status species were observed at this site, and the immediate area provides marginal habitat for wildlife species.

## Removal Action

In meeting with the Base Realignment and Closure (BRAC) Cleanup Team (BCT) during June 1995, Site 7 was designated for removal action. This designation occurred because the nature and extent of contaminants is known and criteria of a Non-Time-Critical Removal Action were satisfied (Section 5 of the Work Plan). An Engineering Evaluation/Cost Analysis (EE/CA), Action Memorandum, and community relations are being prepared for this removal action. During the same series of meetings, Unit 2 of Site 7 was designated for No Further Investigation (NFI) with the agreement that investigations for Site 24 (VOC Source Area) will assess the presence of volatile organics in this unit.

## Statement of Phase II RI/FS Problem

Site 7 is located in the southwest quadrant of MCAS El Toro, north and west of Buildings 295 and 296. The problems associated with this site are the following:

- shallow soil is impacted with VOCs, SVOCs, and petroleum hydrocarbons;
- several metals and SVOCs in shallow soil exceed PRGs and ecological criteria;
- based on LUFT guidelines, petroleum hydrocarbons detected in shallow soil at Site 7 do not appear to pose a threat to groundwater; and
- additional data are needed to calculate a cumulative excess cancer risk and hazard index for the site.

# STEP 2 – IDENTIFY THE DECISION

This step describes the decisions that will be considered during the DQO process for Site 7. For each decision, the alternative outcomes are stated. The Sampling Decision Process is illustrated on Figure G-5. For Site 7, the following decisions will be considered:

1. Do COPCs in shallow soil (less than 10 feet bgs) in the unit exceed established background concentrations and PRGs, and/or do they present an unacceptable risk to human health or the environment?

   If yes, proceed to the next decision.

   If uncertain, collect additional soil samples to determine risk.

   If no, recommend the unit for NFI.

2. Has the extent of impacted soil been defined in the shallow soil?

   If yes, evaluate a response action.

   If no, conduct soil sampling to define extent.

3. Does the extent of impacted shallow soil extend into the subsurface (greater than 10 feet bgs)?

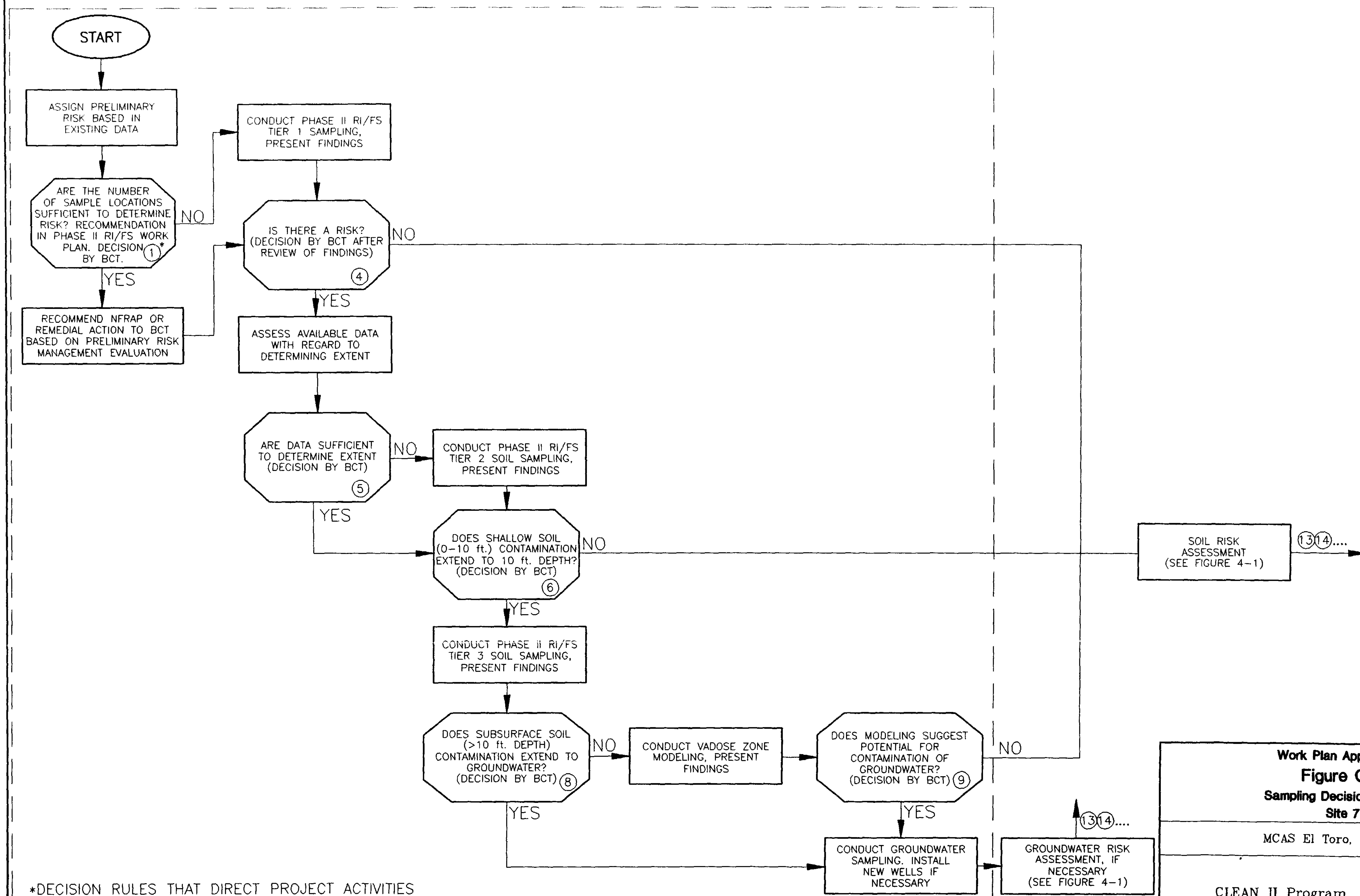
   If yes, conduct soil sampling to define vertical extent of impacted soil, and if necessary, evaluate potential impacts to groundwater beneath the site.

   If no, evaluate a response action.

4. Do the media being evaluated for a response action qualify for Early Action?

   If yes, recommend unit for an EE/CA.

   If no, recommend unit for a remedial response as part of the RI/FS process.




**Work Plan Appendix G**

**Figure G-5**

**Sampling Decision Process**

**Site 7**

MCAS El Toro, California

CLEAN II Program

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# STEP 3 – IDENTIFY THE INPUT AFFECTING THE DECISION

Step 2 defined the decisions addressing possible actions at the site. Step 3 will identify the inputs that are required to assess the actions as discussed below.

## Inputs for No Further Investigation

Input information required to support a NFI recommendation will also be used to support decisions for Early Action and Long-Term Action. These inputs are as follows:

- list of COPCs;
- definition of the extent of impacted soil;
- background concentrations for metals, pesticides, and herbicides;
- determination of risk for the unit; and
- actions levels for the protection of human health and the environment.

## Inputs for Early Action

In addition to the inputs required for a NFI recommendation, input information required to support an Early Action recommendation will include the following:

- applicable or relevant and appropriate requirements (ARARs);
- identification of cleanup standards;
- identification of cleanup technology applicability/limitations that are not extensive operation and maintenance activities; and
- site/unit cleanup in less than 5 years.

## Inputs for Long-Term Action

In addition to the inputs required for a NFI recommendation, input information required to support a Long-Term Action recommendation may include the following:

- ARARs;
- identification of cleanup standards;
- identification of cleanup technology applicability/limitations;
- pilot testing of remedial alternatives; and
- site/unit cleanup in more than 5 years.

## Descriptions of Inputs

The following subsections discuss the inputs required to assess possible response actions.

## CHEMICALS OF POTENTIAL CONCERN

The COPCs for Site 7 include all chemicals detected in the Phase I RI for each medium (Jacobs Engineering 1993c, pages A7-4 to A7-7). COPCs for Site 7 are listed below.

### *Shallow Soil (less than 10 feet below ground surface)*

- metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, zinc;
- VOCs: acetone, benzene, carbon tetrachloride, methylene chloride, xylenes;
- SVOCs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, bis(2-ethylhexyl) phthalate, carbazole, chrysene, dibenzo(a,h)anthracene, diethyl phthalate, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene;
- pesticides and PCBs: 4,4'-DDD, 4,4'-DDE, 4,4'-DDT, dieldrin, endosulfan sulfate, endrin, endrin ketone; and
- fuel and petroleum hydrocarbons: TRPH, TFH-gasoline, TFH-diesel.

### *Subsurface Soil (greater than 10 feet below ground surface)*

- metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, cobalt, copper, lead, manganese, mercury, nickel, selenium, silver, thallium, vanadium, zinc;
- VOCs: 1,1-dichloroethene, 2-butanone, acetone, benzene, carbon tetrachloride, methylene chloride, toluene, trichloroethylene, xylenes;
- SVOCs: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, benzyl butyl phthalate, bis(2-ethylhexyl) phthalate, carbazole, chrysene, dibenzo(a,h)anthracene, diethyl phthalate, fluoranthene, indeno(1,2,3-cd)pyrene, phenanthrene, pyrene; and
- fuel and petroleum hydrocarbons: TRPH, TFH-gasoline, TFH-diesel.

### *Groundwater – On-Site*

- metals: aluminum, antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, manganese, mercury, nickel, selenium, vanadium, zinc; and
- VOCs: carbon tetrachloride, chloroform, methylene chloride.

### *Groundwater – Downgradient*

- metals: antimony, arsenic, barium, beryllium, cadmium, cobalt, manganese, nickel, selenium, silver, vanadium;
- VOCs: 1,1,1-trichloroethane, 1,1-dichloroethene, carbon tetrachloride, chloroform, chloromethane, tetrachloroethene, trichloroethylene;
- SVOCs: bis(2-ethylhexyl) phthalate

- fuel and petroleum hydrocarbons: TFH-gasoline; and
- gross alpha and beta: gross alpha, gross beta.

### THE NATURE AND EXTENT OF CONTAMINATION

Phase II RI/FS sample locations, depths, and chemical analyses have been designed to assess the risk associated with the site. Additional sampling will be conducted if it is necessary to further define the extent of impacted shallow soil, subsurface soil, or groundwater.

### BACKGROUND CONCENTRATIONS

The background concentrations for metals, herbicides, and pesticides are presented in Section 4 of the Phase II RI/FS Work Plan.

### DETERMINATION OF RISK

A determination of the human health risk associated with each site is based on a baseline or streamline risk assessment. Baseline risk assessments are performed on RI/FS sites. The objective of a baseline risk assessment is to estimate the risks associated with the no action alternative and thereby provide decision makers information useful in identifying the most appropriate remedial action alternative. The risk estimates produced also serve as a benchmark to which reductions in risk achieved by remedial actions may be compared. Streamlined risk assessments are performed on removal action sites to support the removal action.

In addition to the human health risk assessment conducted for a site, an ecological risk assessment may also be performed. The ecological risk assessment will evaluate current and potential risks to the environment posed by the chemical releases that have occurred at the sites.

### IDENTIFICATION OF CLEANUP LEVELS

Cleanup levels will be based on ARARs, background concentrations, and risk levels that will be determined for the site.

### CLEANUP TECHNOLOGY EFFECTIVENESS, IMPLEMENTABILITY, AND COSTS

Once cleanup levels have been established, the most appropriate and cost effective approach will be identified to remediate the site, if necessary.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

This step defines the spatial and temporal boundaries of the problem and any practical constraints that may interfere with the study.

- Unit 1 – the North Pavement Edge (approximately 15,000 feet$^2$ and has the same boundaries as Phase I RI Site 7, Stratum 1). This unit is in the Removal Action Process.
- Unit 2 – the Old East Pavement Edge (approximately 42,750 feet$^2$ and has the same boundaries as Phase I RI Site 7 Stratum 2). NFI has been proposed for this unit.
- Unit 3 – the New East Pavement Edge (approximately 27,300 feet$^2$ and has the same boundaries as Phase I RI Site 7 Stratum 3). This unit is in the Removal Action Process.
- Unit 4 – the Drainage Ditch (approximately 27,950 feet$^2$ and has the same boundaries as Phase I RI Site 7 Stratum 4).
- Unit 5 – the Open Dirt Area south of Building 296 (approximately 90,500 feet$^2$ and has the same boundaries as Phase I RI Site 7 Stratum 5).

Specification of temporal boundaries for the field sampling activities is unnecessary. Shallow and deeper subsurface soil conditions are not considered to be significantly different from conditions during the Phase I RI sampling or throughout the period since spillage or unregulated waste disposal activities occurred on the site.

## STEP 5 – DEVELOP A DECISION RULE

Decision rules are required to state explicitly the types of inputs and logical basis for choosing among alternative actions during the Phase II RI/FS. A list of all decision rules for the project are included in Section 4 of the Work Plan. The specific decision rules that will be followed to determine an action are presented here. These decision rules conform to the numbering sequence presented in Section 4 of the Work Plan.

2. If Phase I data are sufficient to assess a response action to reduce risk associated with site units which exceed media action levels or background concentrations, then the cleanup levels and appropriate response action (Early Action or Long-Term Action) will be determined.
3. If Phase I data are not sufficient to assess whether risks are present based on the minimum number of samples, then Tier 1 sampling of the Phase II RI/FS will be completed to supplement the Phase I analytical results so the minimum number of samples is satisfied to assess whether action levels or background concentrations are exceeded in site units.
4. If Phase I data and Tier I data for the Phase II RI/FS indicate that no solid wastes are exposed and respective action levels or background concentrations for the various media of a site unit are not exceeded, then NFI will be recommended.
5. If Phase I data or Tier 1 data of the Phase II RI/FS combined with Phase I data exceed PRGs, action levels, or background concentrations for the various media, then Tier 2 of the Phase II RI/FS sampling and analyses will be conducted to define horizontal and vertical extent, provided additional sampling costs are not more than a potential response action.

6. If PRGs, action levels, or background concentrations for shallow soil are exceeded, and if COPCs detected in the soil extend to 10 feet bgs, then soil below 10 feet bgs (subsurface soil) will be investigated to assess the horizontal and vertical extent of the COPCs.

7. If during the investigation of COPCs in subsurface soil, two consecutive soil sample analyses (at a minimum 5-foot-depth separation) demonstrate that COPCs are not detected, then the vertical extent of soil contamination will be established and investigation of subsurface soil will be halted at that location. The horizontal extent will be established when COPCs are not detected in vertical samples taken at three locations around the sample that exceeds the action levels.

   The lowest detection limit available will be used to define the base of a contaminant plume. COPC detection or quantitation limits that will be compared to establish the base of the contaminant plume include the following:

   - CRDL,
   - contract-required quantitation limit,
   - sample quantitation limit,
   - estimated quantitation limit,
   - practical quantitation limit,
   - method detection limit, and
   - IDL.

8. If during the investigation of COPCs in subsurface soil, it is determined by actual sampling that COPCs extend to the water table, groundwater beneath the site will be investigated for the presence of the COPCs.

9. If COPCs are identified in subsurface soil below 10 feet bgs, above background and action levels, but do not extend to the water table, then vadose zone computer modeling will be used to evaluate the potential for the COPCs to impact groundwater.

10. If it is determined that COPCs in subsurface soil have impacted groundwater causing exceedance of action levels, then the vertical and horizontal extent of groundwater exceedance will be evaluated.

13. If action levels or background concentrations are exceeded for the media of a site unit, then the risk assessment will be initiated, based on sample results, acceptable levels of risk, and potential land uses, to assess potential risks to human health and/or the environment.

14. If unacceptable risks are assessed to human health or the environment, then cleanup levels will be evaluated for each media.

15. If cleanup levels in a given medium are exceeded, and if the site meets at least one of the eight criteria for removal action described in 40 *Code of Federal Regulations*

(CFR) 300.415(b)(2), and the scale and complexity of contaminant distribution in the affected medium are such that excess risk can be expediently reduced utilizing readily available technology, then the medium at the site will be recommended for Early Action.

16. If an early removal action is selected, a non-time-critical EE/CA and Action Memorandum will be completed for the removal action.
17. Once the removal action is completed, the site will be evaluated for residual risk. If a residual risk exists, then a Long-Term Action may be required.
18. If cleanup levels for a given medium are exceeded, and if the site does not meet criteria for an Early Action, then the affected medium will be recommended for long-term remedial action as part of the RI/FS process; and an FS will be completed, followed by a Record of Decision, Remedial Design, and Remedial Action RA to clean up the site for closure.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The purpose of Step 6 is to establish limits for decision errors, which are used by the decision makers to establish performance goals for the data collection design. The objective of the data collection design is to obtain data that reliably estimate the true nature of environmental conditions at Site 7. This process is presented in Section 4 of the Work Plan and the following presents specific information on Site 7.

### Identify the Null Hypothesis and Identify the Decision Errors

The null hypothesis for this site specifies that the concentrations of one or more of the COPCs exceed PRGs or risk-based action levels and represent an unacceptable risk at the site.

The alternative hypothesis for this site specifies that the concentrations of one or more of COPCs do not exceed PRGs or risk-based actions levels and represent an acceptable risk at the site.

The false-positive and false-negative decision errors are discussed in Section 4 of the Work Plan.

### Decision Error Limits

For the Phase II RI/FS, the allowable probability of making a false-positive decision has been designated as 0.05 (confidence of 95 percent) and an allowable probability of making a false-negative decision error has been designated as 0.20 (power of 80 percent).

### Calculating the Number of Samples Necessary to Determine Risk

The number of sample locations necessary to determine the risk at a unit or a site were estimated using the process presented in Section 4 of the Work Plan. The number of additional sample locations needed to assess risk during the Phase II RI/FS is the difference between the total number of sample locations and the number of locations sampled during the Phase I RI (Table G-1).

### Sampling Designs for the OU-3 Sites

Three types of sampling designs will be used to determine the soil conditions at Site 7. The sampling designs are:

- stratified random sampling (either whole or partial unit areas, with replacement where sample locations are closely spaced or overlap);
- systematic random sampling along an axis (with replacement if new and existing sample locations overlap or are closely spaced); and
- judgmental sampling.

Descriptions of these Phase II RI/FS sampling designs are presented in Section 4 of the Work Plan. The first two sampling designs utilize random positioning to produce an unbiased configuration of sample locations. The advantage of a random, unbiased sampling design, is that the tolerance limits for false-positive and false-negative decision errors can be applied to the sample data and the risk decisions can be assigned a level of confidence.

The third sampling design is judgmental sampling. The purpose of judgmental sampling is to provide answers to more specific questions or issues where considerable information on the parameters of a population already exists. Confidence and power limits associated with statistically based sampling designs do not apply directly to judgmentally located samples. Decision errors must still be considered for judgmental samples, however, they will not be evaluated statistically. The decision errors associated with judgmental sampling are based on sample design errors and measurement errors. Assuming the best possible professional judgment was used to position the judgmental sample locations using existing data for the site, the most important decision errors will be associated with field and laboratory techniques involved with collection and analysis of the data. This makes careful application of field and laboratory techniques even more critical due to the fact that corroborative data from multiple sample locations may not be available, nor will it be statistically evaluated.

## STEP 7 – OPTIMIZE THE DESIGN

Historic site activities, previous site investigation results, and regulatory comments were used to formulate the Phase II RI/FS sampling approach. Shallow and deeper subsurface soils will be investigated at this site using a tiered sampling approach. This sampling approach consists of three tiers:

## Table G-1
## Summary of Phase II RI/FS OU-3 Soil Sampling Strategies

| Description | Unit Area | Estimated Risk | Number of Locations/ Samples[b] | Number of Phase I Locations/ Samples | Number of Phase II Locations/ Samples | Tier | Type of Sampling Strategy |
|---|---|---|---|---|---|---|---|
| Site 7–Drop Tank Drainage No. 2 | Unit 4–27,950 $ft^2$ | $< 10^{-6}$ (0.08) | 12/(42) | 3(6) | 3(9)[c] | 1 | Systematic Random on an Axis |
| | Unit 5–90,500 $ft^2$ | $10^{-5}$ (2) (1.80) | 6(18) | 4(8) | 2(6) | 1 | Stratified Random: partial area |

Notes:

[a] These estimated cumulative cancer risk values were developed using Phase I RI data, and COPC-specific risk-based concentrations were developed following completion of Phase I RI activities. Numbers in parentheses are the estimated hazard index values.

[b] Number of samples based on comparison of estimated cancer risk to Table 4-7 in Phase II RI/FS Work Plan, which correlates four cancer-risk categories to the number of samples needed to determine that risk using the project-specific power and confidence limits. For this column, the first number represents sample locations, and the second number (in parentheses) is the number of samples based on an average of three depth intervals per sample location.

[c] These numbers represent the difference between the number of samples required to determine risk and the number of samples collected as part of the Phase I RI, with the following provisions:
Where Phase II RI/FS sample locations were recommended to determine risk, the area covered by this number of locations was based upon the U.S. EPA risk determination standard of a 40- x 40-meter block per sample location. This corresponds to an area of about 206,700 $feet^2$ for 12 sample locations. If the unit area is greater than this size limit, the maximum specified number of samples, less the Phase I RI number of samples, will be collected during the Phase II RI/FS. If the unit area is less than this size limit, the number of sample locations represents a ratio of the unit area versus the 12-sample area (206,700 $feet^2$) times 12 (e.g., Site 19, Unit 3: [Unit 3 area/206,700 $feet^2$]) x 2 locations = 9 locations needed - 3 Phase I locations = 6 new Phase II RI/FS locations required. Use of this ratio rule should maintain the necessary power and confidence limits at units where fewer samples are collected. At units where the ratio rule is applied, the total number of samples (Phase I and Phase II combined) will never be less than six despite the ratio calculation, to be sure that the minimum number of sample locations necessary for a risk assessment is collected. The number of Phase II RI/FS shallow soil boring locations has been based on three samples per location. However, at Site 8 (Unit 3) and Site 12 (Units 1, 2, and 4), four samples per location will be collected.

- The main focus of the Tier 1 sampling plan will be to determine whether the unit is a risk. The Tier 1 sampling approach will consist of collecting shallow soil samples (less than 10 feet bgs) from a specific number of sampling locations within the unit. The number of sampling locations has been proposed such that when the Phase I and II RI/FS data are evaluated together, an assessment of risk can be completed for the unit.
- The Tier 2 sampling approach will also focus on shallow soil; however, the primary objective will be to refine the extent of shallow soil that has been impacted by site activities, by focusing on subareas of the unit where COPCs exceeded PRGs as identified by the Tier 1 sampling and/or Phase I RI/FS results.
- The Tier 3 sampling approach has been designed to estimate the horizontal and vertical extent of impacted subsurface soil (greater than 10 feet bgs). This sampling strategy will only be implemented if Phase I RI/FS soil sample analytical data or Phase II RI/FS Tier 1/Tier 2 soil sample analytical data suggest impacted soil exists at depths greater than 10 feet bgs. Groundwater will be investigated if Phase I or Phase II soil data indicate potential impacts to groundwater are possible.

The tiered sampling approach is detailed in the following sections and in the Phase II RI/FS FSP, Attachment G (BNI 1995). For a list of all soil sampling and analysis at Site 7, see Table G-2.

## Tier 1

Tier 1 sampling will be collection of shallow samples from each unit within the site as described below. A summary of the number of sample locations, number of samples, and sample analyses is presented in Table G-2.

### TIER 1 SOIL SAMPLING

Tier 1 sample locations in both the units will be positioned in stratified random sampling, systematic random sampling on an axis, or judgmental sampling locations to characterize additional areas not sampled as part of the Phase I RI/FS (Figure G-2).

#### *Unit 1: North Pavement Edge*

Unit 1 is presently being addressed as a Early Action through the Non-Time-Critical Removal Action process. An EE/CA has been prepared for this unit.

#### *Unit 2: Old East Pavement Edge*

In the Phase I RI, COPCs detected in shallow soil include VOCs, SVOCs, petroleum hydrocarbons, and metals. No COPCs detected in the shallow soil exceeded PRGs, and only cobalt exceeded ecological screening criteria. This part of Site 7 is presently covered by approximately six inches of concrete; therefore, ecological habitat is absent and human contact with under lying soil is unlikely. Based on Phase I RI, this unit is

## Table G-2
## Soil Sampling and Analysis

| Tier | Unit/Name | PHASE II RI/FS SAMPLE NUMBERS | | | FIELD[a] - IMMUNOASSAY OR MOBILE LABORATORY | | | | | OFF-SITE LABORATORY[b] | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. of Locations | Samples/ Location | Total Samples | PAH[c] | PCBs[c] | VOCs[d] | TPH Gas and Diesel[d] | Target Analyte List - Metals[d] | PCBs and Pesticides | Herbicides | Others: |
| Tier 1 | Unit 4 Drainage Ditch | 3 | 3 | 9 | X | | X | X | X | X | | |
| | Unit 5 Open Dirt Area | 2 | 3 | 6 | X | | X | X | X | X | | |
| *Tier 1 Subtotals* | | | | 15 | 15 | | 15 | 15 | 15 | 15 | | |
| Tier 2 | Optional: Scope of Tier 2 would be to further define extent of shallow soil contamination; based on Tier 1 data and Phase I RI findings, RFA data, and soil gas survey results, with approval of BCT | | | | | | | | | | | |
| Tier 3 | Optional: Scope of Tier 3 would be to characterize horizontal and vertical extent of contamination below 10 feet depth; based on Tier 1 and 2 data, Phase I RI findings, soil gas survey results and/or RFA data, with approval of BCT | | | | | | | | | | | |

Notes:
[a] For QA/QC support and verification, six samples from Unit 4 and three samples from Unit 5 will go to the off-site laboratory for confirmation analyses.
[b] These constituents cannot be determined in the field; all samples to be analyzed for these constituents will be sent to the off-site laboratory.
[c] immunoassay analyses
[d] mobile laboratory analyses

recommended for NFI for OU-3. Two areas identified by the soil gas survey in the southern portion of this unit will be further investigated by the VOC Source Area Investigation (Site 24) for VOCs in soil.

### *Unit 3: New East Pavement Edge*

Unit 3 has been approved for Early Action and is being addressed through the Non-Time-Critical Removal Action process. An Engineering Evaluation/Cost Analysis will be prepared for this unit.

### *Unit 4: Drainage Ditch*

The objectives of this investigation are to collect sufficient data to confirm possible NFI recommendation and support risk assessment.

During the Phase I RI, three locations were sampled in Unit 4. The analytical results for soil indicated no COPCs exceeded PRGs and only lead exceeded ecological screening criteria.

In the Phase II RI, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at three systematic random sample locations on an axis. All soil samples will be field screened for polynuclear aromatic hydrocarbons (PAH) by immunoassay test kits (U.S. EPA Method 4035), for TPH (U.S. EPA Method 8015M) and for VOCs (U.S. EPA Method 8010) by an appropriately equipped mobile laboratory. However, soil samples collected above 3 feet bgs during the Phase II RI/FS will not be analyzed for VOCs (U.S. EPA Method 8010) due to the outgassing of volatiles resulting in a reduction of VOC concentrations at these depths. All samples will be analyzed for pesticides/PCBs (U.S. EPA Method 8080) by a fixed-base laboratory under Naval Facilities Engineering Service Center (NFESC; formerly known as NEESA) Level D protocols. For quality assurance/quality control (QA/QC) support and verification, six samples (four detects and two nondetects).will be submitted to the fixed-base laboratory to be analyzed for SVOCs (U.S. EPA Method 8270) for the PAH immunoassay verification, for TPH (U.S. EPA Method 8015M), and for VOCs (U.S. EPA Method 8010) under NFESC Level D protocols. For complete details on the Phase II RI/FS sampling program, please refer to Attachment G in the FSP (BNI 1995).

### *Unit 5: Open Dirt Area*

The objectives of this investigation are to collect sufficient data to confirm extent of contamination and support risk assessment. Following Tier 1 sampling, it is anticipated this unit will be addressed as an Early Action through the Non-Time-Critical Removal Action Process.

During the Phase I RI, three locations were sampled in Unit 5. The analytical results for soil indicated one SVOC, lead, and dieldrin exceeded PRGs; and one SVOC, mercury, and lead exceeded ecological screening criteria.

In the Phase II RI, Tier 1 soil samples will be collected at 0, 5, and 10 feet bgs at two stratified random sample locations. All soil samples will be field screened for PAH by immunoassay test kits (U.S. EPA Method 4035), for TPH (U.S. EPA Method 8015M) and for VOCs (U.S. EPA Method 8010) by an appropriately equipped mobile laboratory. However, soil samples collected above 3 feet bgs during the Phase II RI/FS will not be analyzed for VOCs (U.S. EPA Method 8010) due to the outgassing of volatiles resulting in a reduction of VOC concentrations at these depths. All samples will also be analyzed for pesticides/PCBs (U.S. EPA Method 8080) by a fixed-base laboratory under NFESC Level D protocols. For QA/QC support and verification, three samples (two detects and one nondetect) will be submitted to the fixed-base laboratory to be analyzed for SVOCs (U.S. EPA Method 8270) for the PAH immunoassay verification, for TFH (U.S. EPA Method 8015M), and for VOCs (U.S. EPA Method 8010) under NFESC Level D protocols. For complete details on the Phase II RI/FS sampling program, see Attachment G in the FSP (BNI 1995).

## Tier 2

The primary objective of the Tier 2 sampling program is to refine the extent of impacted soil identified within each unit by Phase I and/or II RI/FS sampling results. The Tier 2 sampling program will focus exclusively on shallow soil (0 to 10 feet depth) conditions and will further investigate subareas within the unit boundary that exceed PRGs.

The Tier 2 sampling plan will be developed after an evaluation of Phase I RI/FS and/or Phase II RI Tier 1 analytical results. If a Tier 2 sampling program meets the DQOs for this unit, the decision to proceed will be based upon the criteria described in DQO Steps 2, 3, and 5. The proposed Tier 2 sampling plan, with recommendations, will be reviewed by the BCT. The BCT will decide whether the proposed Tier 2 sampling program will be implemented by the Navy.

### TIER 2 SOIL SAMPLING

As noted, the objective of a Tier 2 sampling program is to refine the extent of impacted shallow soil within the unit being investigated. The rationale for accomplishing this objective depends primarily on the size and layout of the unit. Where the unit is a linear feature such as a drainage ditch, the Tier 2 program will focus sampling along the trend of the ditch bracketing the Tier 1 sampling locations (or Phase I RI/FS sample locations) where analyte concentrations exceeding PRGs are reported.

For units of rectangular, roughly circular, or irregular dimensions, a systematic random sampling based on a grid, stratified random sampling, or judgmental sampling approach will be used to define the extent of the Tier 1 sample location(s) where analyte concentrations exceeded PRGs. The limits of the area covered by these sampling approaches will be contingent upon the distribution of adjacent Tier 1 sample locations in which the COPCs were not detected.

The number of Tier 2 sampling locations (i.e., grid spacing) will be selected to achieve the following objectives:

- provide the areal coverage necessary to define the extent of shallow impacted soil, and
- minimize the cost associated with field and fixed-base laboratory sample testing.

The spacing between sampling locations for Tier 2 will be contingent upon the estimated size of the area to be investigated, and the spacing between Phase I or II RI/FS sample locations. Tier 2 soil sample depth intervals and chemical analyses will conform to those specified for Tier 1 soil sampling.

## Tier 3

The Tier 3 sampling program would only be implemented at a unit where Phase I RI data, or the initial evaluation of the Phase II RI Tier 1 and/or Tier 2 sampling program results suggest that soil contamination may extend to depths greater than 10 feet bgs.

The objectives of the Tier 3 sampling program are to estimate the horizontal and vertical extent of impacted subsurface soil (greater than 10 feet bgs) and assess whether groundwater beneath the site has been impacted by historic site activities. If impacted subsurface soil is limited to the vadose zone above the water table or vadose zone modeling does not suggest a potential for COPCs to impact groundwater, then groundwater quality will not be investigated.

The Tier 3 sampling plan will be developed after an evaluation of Phase I RI/FS and Phase II RI Tier 1 and/or 2 analytical results. If a Tier 3 sampling program meets the DQO for this unit, then the decision to proceed will be based upon the criteria described in DQO Steps 2, 3, and 5. The proposed Tier 3 sampling plan, with recommendations, will be reviewed by the BCT. The BCT will decide whether the proposed Tier 3 sampling program will be implemented.

## Optimization of Sampling Plan

As soil analytical data become available from sampling in each unit, investigative plans for the site will be optimized. The proposed tiered sampling approach is an iterative process that will permit data from one tier to be evaluated prior to the implementation of the next tier of sampling. The iterative process involves review of data, recommendations for further actions, and approval of the BCT. In this way, the investigation can be optimized by performing the least amount of sampling necessary to assist the decision making process about future actions at the unit (i.e., NFI, Early Action, and Long-Term Action).

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# DATA QUALITY OBJECTIVES
# OPERABLE UNIT 3 –
# SITE 8 – DEFENSE REUTILIZATION AND MARKETING OFFICE STORAGE YARD

# SUMMARY

## STEP 1 – STATE THE PROBLEM

Site 8, the Defense Reutilization Marketing Office Storage Yard, continues to be used for the storage and sale of containerized liquids and scrap or salvage materials. Drummed liquids such as lubrication oil, fuels, and solvents may have spilled or leaked, impacting soil at the site. Soil was also impacted by spillage of polychlorinated biphenyl oil from scrap electrical components stored at the site. The human health and ecological risks associated with the impacted soil will be estimated so that No Further Investigation or the appropriate remedial alternative can be recommended for the units within Site 8.

## STEP 2 – IDENTIFY THE DECISION

The Phase II Remedial Investigation/Feasibility Study decisions to be considered at Site 8 are as follows: Do chemicals of potential concern in the shallow soil at Site 8 present an unacceptable risk to human health and the environment? Are the chemicals of potential concern present in the subsurface soil (greater than 10 feet below ground surface), and if so, do they present an unacceptable risk to groundwater? The possible decision outcomes include recommendations for No Further Investigation, and Early Action or Long-Term Action.

## STEP 3 – IDENTIFY THE INPUTS AFFECTING THE DECISION

Inputs necessary to make these decisions include a list of chemicals of potential concern; the extent of impacted media; the background (ambient) concentrations of metals, herbicides, and pesticides; and the action levels for protection of human health and the environment.

## STEP 4 – DEFINE THE BOUNDARIES OF THE STUDY

The study is limited to the geographic area of Site 8, which comprises five subareas: 1) the Eastern Storage Yard (approximately 59,100 square feet) presently a Removal Action unit; 2) the West Storage Yard (approximately 118,900 square feet); 3) the Refuse Pile Area (approximately 3,750 square feet); 4) the polychlorinated biphenyl Spill Area (approximately 1,500 square feet), presently a Removal Action unit; and 5) the Old Salvage Yard (approximately 104,160 square feet).

## STEP 5 – DEVELOP A DECISION RULE

Action levels developed for decision-making purposes are a cumulative excess cancer risk of $10^{-6}$ in humans and a hazard index of 1.0 for chronic systemic toxicity in humans. Based on these risk levels, decision rules have been formulated to protect human health and the environment in residential, recreational, and industrial land use scenarios.

## STEP 6 – SPECIFY LIMITS ON UNCERTAINTY

The number of samples necessary to estimate different levels of risk were calculated using the confidence level of 95 percent and power level of 80 percent limits specified for this project. The preliminary cancer and noncancer risk values were compared to the risk levels, and the appropriate number of samples necessary to estimate risk were selected for each unit.

## STEP 7 – OPTIMIZE THE DESIGN

Shallow soil samples will be collected and analyzed at 0, 2, 4, and 10 feet below ground surface at two locations from the Western Storage Yard; at 0, 2, 4, and 10 feet below ground surface at four locations in the Refuse Pile Area (soil under the former refuse pile location); and at 0, 2.5, and 10 feet below ground surface at six locations from the Old Salvage Yard.

# ACRONYMS/ABBREVIATIONS

| | |
|---|---|
| AOC | area of concern |
| ARAR | applicable or relevant and appropriate requirement |
| BCT | BRAC Cleanup Team |
| bgs | below ground surface |
| BRAC | Base Realignment and Closure |
| COPC | chemical of potential concern |
| CRDL | contract-required detection limit |
| DDE | dichlorodiphenyldichloroethene |
| DQO | data quality objective |
| DRMO | Defense Reutilization and Marketing Office |
| EE/CA | Engineering Evaluation/Cost Analysis |
| FS | Feasibility Study |
| FSP | Field Sampling Plan |
| IDL | instrument detection limit |
| LUFT | (California) Leaking Underground Fuel Tank (Field Manual) |
| MCAS | Marine Corps Air Station |
| MCL | maximum contaminant level |
| μg/kg | micrograms per kilogram |
| μg/L | micrograms per liter |
| mg/kg | milligrams per kilogram |
| mg/L | milligrams per liter |
| NEESA | Naval Energy and Environmental Support Activity |
| NFESC | Naval Facilities Engineering Service Center |
| NFI | No Further Investigation |
| PAH | polynuclear aromatic hydrocarbons |
| PCB | polychlorinated biphenyl |
| PRG | (U.S. EPA Region IX) Preliminary Remediation Goal |
| QA/QC | quality assurance/quality control |
| RCRA | Resource Conservation and Recovery Act |
| RFA | RCRA Facility Assessment |

## ACRONYMS/ABBREVIATIONS (continued)

| | |
|---|---|
| RI | Remedial Investigation |
| RI/FS | Remedial Investigation/Feasibility Study |
| SAIC | Science Applications International Corporation |
| SVOC | semivolatile organic compound |
| SWMU | solid waste management unit |
| TAL | target analyte list |
| TDS | total dissolved solids |
| TFH | total fuel hydrocarbons |
| TPH | total petroleum hydrocarbons |
| TRPH | total recoverable petroleum hydrocarbons |
| U.S. EPA | United States Environmental Protection Agency |
| VOC | volatile organic compound |

## Appendix H
# SITE 8 – DEFENSE REUTILIZATION AND MARKETING OFFICE STORAGE YARD

The United States Environmental Protection Agency (U.S. EPA) developed the data quality objective (DQO) process as a tool for project managers to determine the type, quantity, and quality of data needed to make decisions. Data produced by sampling and monitoring activities are used extensively in problem definition, rule-making, and enforcement decisions. These activities are supported through implementation of the mandatory U.S. EPA Quality System, which requires all organizations to develop and operate management processes and structures for assuring that the data collected are of the necessary and expected quality for their desired use (U.S. EPA 1993).

The U.S. EPA DQO process consists of the following seven steps.

1. **State the problem**: Describe the problem at the site as it is currently understood. The problem statement includes a site conceptual model and an organization and review of all relevant data.
2. **Identify the decision**: Determine an if-then statement that will define what the investigation will seek to determine and what actions will be taken based on the possible outcomes of the investigation.
3. **Identify inputs into the decision:** Specify the exact analytes or parameters to be measured and used.
4. **Define the study boundary**: Delineate the study boundary from information obtained from Step 1.
5. **Develop a decision rule**: Restate the decision detailing the if-then statement in specific terms.
6. **Specify acceptable limits on decision errors**: Specify how the data will be treated statistically and what the acceptable limits of uncertainty are.
7. **Optimize the design**: Design the field investigation, giving adequate consideration to the results of Steps 5 and 6. This step is described in more detail in the Field Sampling Plan (FSP).

The following sections describe the DQO process for Site 8 – Defense Reutilization and Marketing Office (DRMO) Storage Yard.

## STEP 1 – STATE THE PROBLEM

Site 8 is used for the storage and sale of containerized liquids and scrap or salvage materials. Drummed liquids such as lubrication oil, fuels, and solvents may have spilled or leaked, contaminating soil at the site. Soil was also contaminated by spillage of polychlorinated biphenyls (PCBs) oil from scrap electrical components stored at the site. Although groundwater beneath Site 8 contains volatile organic compounds (VOCs), Site 8 does not appear to be a source of VOC contamination. The source of VOC groundwater contamination is being investigated as part of Site 24, the VOC Source Area.

## Site Description

Site 8, the DRMO Storage Yard, is located in the southwest corner of the South Marine Way and R Street in the southern quadrant of Marine Corps Air Station (MCAS) El Toro (Figure H-1). Site 8 is a storage area for containerized liquids and for scrap and salvage materials. The scrap materials include mechanical and electrical components, and various types of liquids. Typical DRMO materials include surplus or used equipment. The DRMO has a tracking record of the materials presently stored at the site.

Site 8 comprises two areas of concern (AOCs): the old salvage yard and the current storage yard. These two areas were subdivided into five areas for the Phase I Remedial Investigation (RI): 1) the eastern section of the current storage yard; 2) the western section of the current storage yard; 3) the refuse pile area (actually the soil beneath the former refuse pile); 4) the PCB spill area; and 5) the old salvage yard (Figure H-2). Site boundaries for the MCAS El Toro Phase I RI were determined by the Navy and regulatory agencies before beginning the Phase I RI. AOCs were generally grouped together into sites based on common historical activities, areal photograph review, and their respective locations relative to one another.

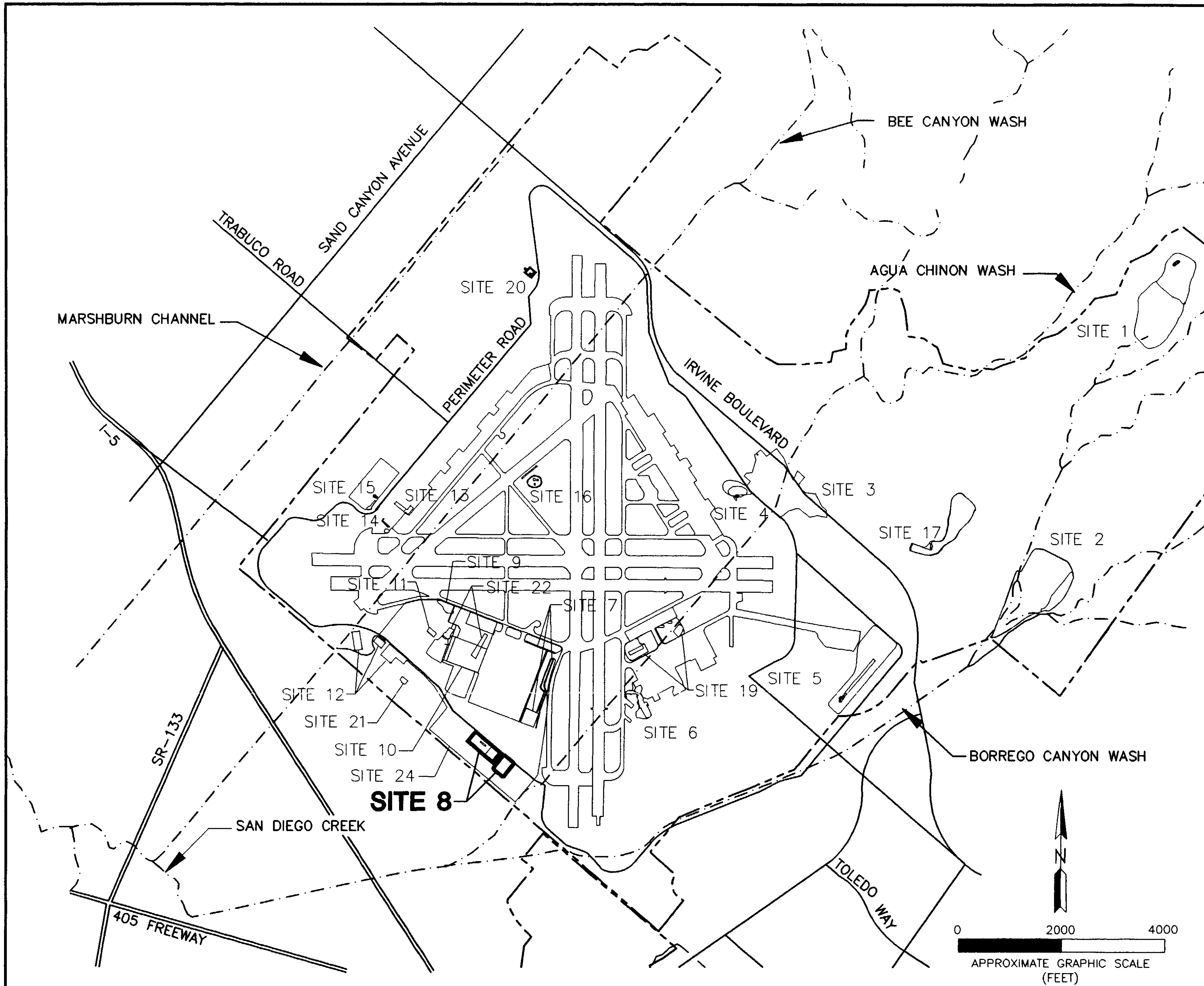
The current storage yard is a fenced, partially paved lot and remains operational. It is located immediately north of Building 360 and occupies approximately 4.5 acres.

The old salvage yard, located across R Street and immediately east of the current storage yard, comprises approximately 2.5 acres. It is presently used as a parking lot for the adjacent Building 800. The original ground surface of the old salvage yard is covered with approximately 5 feet of fill soil.

In 1984, approximately 5 gallons of PCB Aroclor containing oil from a leaking electrical console were spilled in a small area in the eastern section of the current storage yard (Figure H-2). PCB Aroclor contaminated soil in the spill area (approximately 1,500 square feet at the eastern section of the yard) were excavated to a depth of 1 foot below grade. A hazardous waste contractor transported the excavated soil to an off-site disposal facility. There are no other documented spills in the current yard storage yard (Jacobs Engineering 1993a).

Near the center of the area designated as the west section of the current storage yard, a rubbish pile was observed on aerial photographs dating back to 1952 and remained visible in areal photographs through 1990. The pile was removed and disposed before the Phase I RI in 1991.

In December 1993, the top 2 feet of the soil formerly beneath the refuse pile (approximately 229 cubic yards) were excavated and removed from Site 8 by a paving contractor. The excavated soil was placed on the slopes of Bee Canyon Wash. Before its excavation and removal, soil sample analytical results from the Phase I RI indicated the soil was contaminated with PCBs. The soil was overexcavated, stockpiled, and covered with Visqueen™. The stockpiled soil was then characterized by the Navy Public Works




**Work Plan Appendix H**

**Figure H-1**
**Site Location**
**Site 8 - DRMO Storage Yard**

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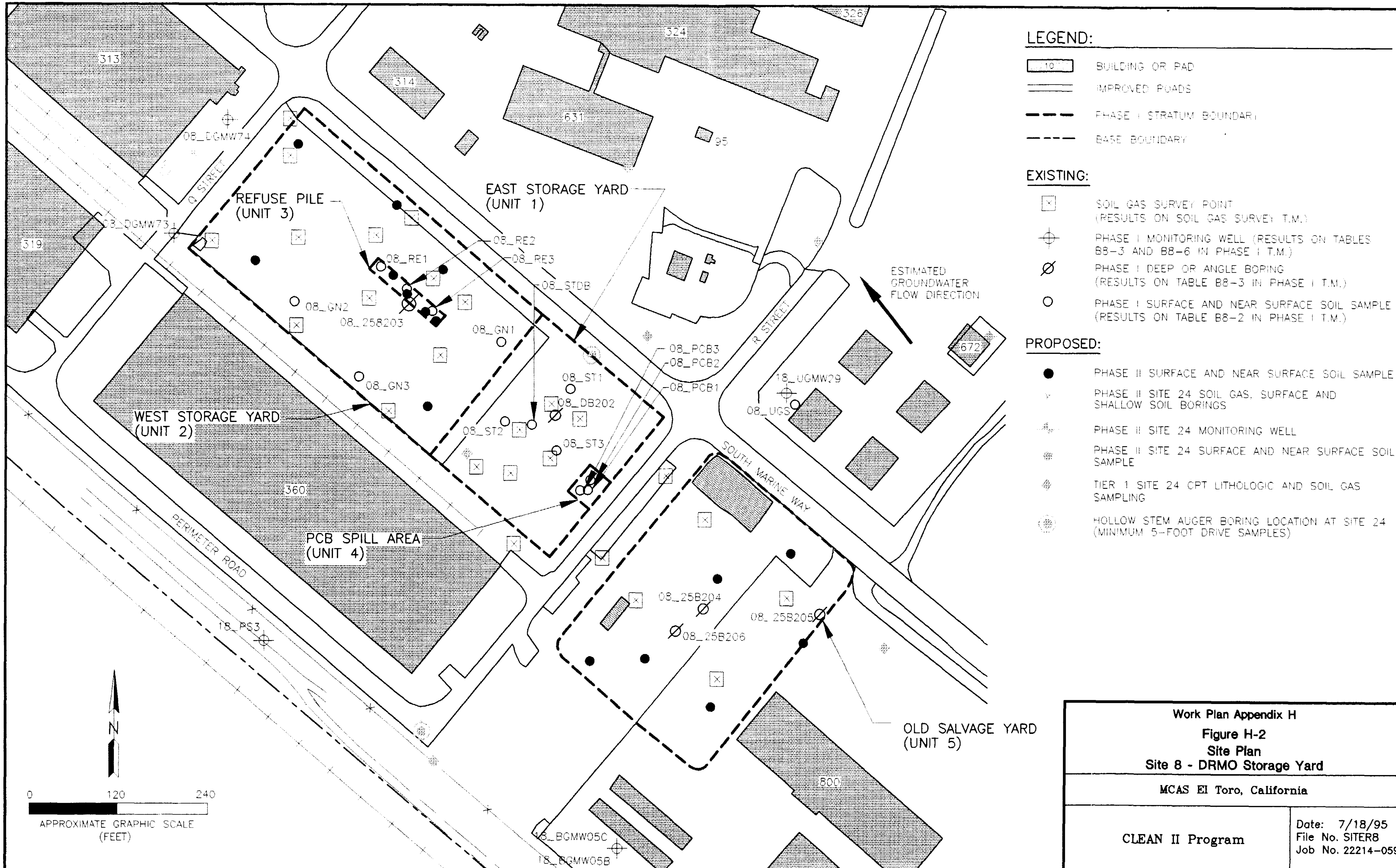


Work Plan Appendix H

**Figure H-2**
**Site Plan**
**Site 8 - DRMO Storage Yard**

MCAS El Toro, California

CLEAN II Program

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Center San Diego. The soil sample analytical results indicate the concentrations of metals and PCBs in the stockpile are below levels deemed hazardous by the U.S. EPA and by the California EPA.

## Previous Investigations

Investigations conducted at Site 8 include a Resource Conservation and Recovery Act (RCRA) Facilities Assessment (RFA), a Phase I RI, the areal photographic surveys, a shallow soil gas survey, and employee interviews. The subsections below summarize these investigations.

### RCRA FACILITIES ASSESSMENT

The RFA identified three drum storage areas (solid waste management unit [SWMU]/AOCs) 104, 105, and 106) within the boundaries of Site 8, the exact locations of these SWMU/AOCs are not known (Jacobs Engineering 1993b). Due to the fact that these areas were located within Site 8, RFA investigation was waived and the SWMU/AOCs were incorporated into the Phase II RI/Feasibility Study (FS). These drum storage areas were not isolated from the general storage practices that took place within the DRMO storage yard. Further, no evidence has been presented to suggest leakage of materials from drums in these storage areas, or that drum storage in these areas was significantly different from other storage activities within the DRMO Yard. Therefore, the drum storage areas will be investigated as part of Site 8 during the Phase II RI/FS.

### PHASE I REMEDIAL INVESTIGATION

For the Phase I RI, subareas within sites were designated as strata. Due to the fact that some new subareas have been added or subareas have been expanded or diminished for the Phase II RI/FS, subareas within sites will be referred to as units for the Phase II RI/FS. In this section, discussion is related to Phase I RI sampling and results, and the term strata will be used. Following this section, the term unit will be used.

In the Phase I RI, Site 8 was divided into the following five strata (Figure H-2):

- Stratum 1 – the Eastern Section of the Current Storage Yard;
- Stratum 2 – the Western Section of the Current Storage Yard;
- Stratum 3 – the Refuse Pile Area;
- Stratum 4 – the PCB Spill Area; and
- Stratum 5 – the Old Salvage Yard.

The following field activities were conducted during the Phase I RI:

- surface and shallow soil samples from were collected at 14 locations (three locations in Strata 1, 2, 3, and 4 and one upgradient, and one at the deep boring);
- one 75-foot soil boring was drilled and sampled in Stratum 1;

- four 25-foot borings were drilled and sampled, three in Stratum 5 and one in Stratum 3;
- one upgradient monitoring well (08_UGMW29)and two downgradient monitoring wells (08_DGMW73 and 74) were installed and sampled;
- soil samples were analyzed for VOCs, semivolatile organic compounds (SVOCs), pesticides/PCBs, herbicides (1 sample in Stratum 1 and the ten samples in Stratum 3), total recoverable petroleum hydrocarbons (TRPH), total fuel hydrocarbons (TFH), and target analyte list (TAL) metals; and
- groundwater samples were analyzed for general chemistry, VOCs, SVOCs, pesticides/PCBs, herbicides (only samples from the two downgradient monitoring wells 08_DGMW73 and 74), TFH, total cyanide, metals.

A summary of the ranges of analyte concentrations detected during the Phase I RI, (sample identification of the highest concentration is provided) plus recent groundwater monitoring data are presented below. All chemicals of potential concern (COPCs) that were detected in soil are listed with the exception of specific metals which are listed only if U.S. EPA Region IX Preliminary Remediation Goals (PRGs) or ecological screening criteria in shallow soil were exceeded. All COPCs exceeding PRGs or maximum contaminant levels (MCLs) in groundwater are included in this list. If a minimum concentration is recorded with a "less than" symbol, it denotes a concentration below the contract laboratory program detection limit. Sample locations are shown on Figure H-2. A complete listing of all detected chemicals is presented in the Phase I RI Technical Memorandum, Appendix B-8, Tables B8-2 through B8-7, (Jacobs Engineering 1993a), and in the Groundwater Quality Data Report (Jacobs Engineering 1994a). TAL metals that were analyzed during the Phase I RI are beryllium, barium, arsenic, antimony, aluminum, cadmium, calcium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

***Shallow Soil (less than 10 feet below ground surface )***

- metals: aluminum (2,410 to 29,800 micrograms per kilogram [μg/kg] [08_RE2 at 4 feet]), barium (17.8B to 287 μg/kg [08_RE2 at 4 feet]), cadmium (< 0.25 to 108 μg/kg [08_RE2 at 0 feet]), copper (2.3B to 213 μg/kg [08_RE2 at 0 feet]), lead (0.76 to 1,520 μg/kg [08_ST3 at 0 feet]), mercury (< 0.03 to 15.1 μg/kg [08_RE2 at 0 feet]), nickel (< 1.6B to 70.3 μg/kg [08_RE2 at 0 feet]), zinc (12.9 to 1,510 μg/kg [08_RE2 at 0 feet]), and 15 other TAL metals;
- VOCs: 2-butanone (< 10 to 4J μg/kg [08_RE2 at 4 feet]), 2-hexanone (< 10 to 13 μg/kg [08_ST1 at 0 feet]), acetone (< 10 to 11 μg/kg [08_PCB3 at 4 feet]), ethylbenzene (< 10 to 2J μg/kg [08_GN1 at 0 feet]), methylene chloride (< 10 to 66 μg/kg [08_RE2 at 0 feet]), tetrachloroethene (< 10 to 4J μg/kg [08_RE2 at 0 feet]), xylenes (< 10 to 16 μg/kg [08_GN1 at 0 feet]), toluene (< 10 to 10J μg/kg [08_RE2 at 0 feet]);

- SVOCs: benzo(a)pyrene (< 670 to 150J µg/kg [08_ST2 at 0 feet]), benzo(g,h,i)perylene (< 670 to 140J µg/kg [08_ST1 at 0 feet]), benzyl butyl phthalate (< 670 to 1,900 µg/kg [08_RE2 at 0 feet]), bis(2-ethylhexyl)phthalate (< 670 to 8,800 µg/kg [08_RE2 at 0 feet]), chrysene (< 670 to 160J µg/kg [08_RE2 at 0 feet]), dimethyl phthalate (< 670 to 330J µg/kg [08_RE2 at 0 feet]), di-n-butyl phthalate (< 670 to 470J µg/kg [08_RE2 at 0 feet]), fluoranthene (< 670 to 160J µg/kg [08_RE2 at 0 feet]), hexachloroethane (< 670 to 140J µg/kg [08_RE2 at 0 feet]), indeno(1,2,3-cd)pyrene (< 670 to 150J µg/kg [08_ST1 at 0 feet]), pyrene (< 670 to 230J µg/kg [08_RE2 at 0 feet]);
- pesticides and PCBs: alpha chlordane (< 1.76 to 453 µg/kg [08_RE2 at 0 feet]), BHC-alpha (< 1.76 to 3.57 µg/kg [08_RE1 at 2 feet]) 4,4'-dichlorodiphenyldichloroethane (< 3.36 to 122D µg/kg [08_PCB1 at 0 feet]), 4,4'-dichlorodiphenyldichloroethene (DDE) (< 3.45 to 35.7 µg/kg [08_ST2 at 0 feet]), 4,4'-dichlorodiphenyltrichloroethane (< 3.4 to 170 µg/kg [08_ST1 at 0 feet]), dieldrin (< 3.43 to 836 µg/kg [08_RE2 at 0 feet]), endosulfan I (< 1.76 to 63.5J µg/kg [08_PCB3 at 0 feet]), endosulfan II (< 3.43 to 60D µg/kg [08_PCB1 at 0 feet]), endosulfan sulfate (< 3.42 to 12J µg/kg [08_PCB1 at 0 feet]), endrin (< 3.43 to 216 µg/kg [08_RE1 at 0 feet]), endrin aldehyde (< 3.4 to 292 µg/kg [08_RE2 at 0 feet]), endrin ketone (< 3.36 to 3.54J µg/kg [08_PCB3 at 2 feet]), gamma chlordane (< 1.76 to 75.8 µg/kg [08_RE2 at 0 feet]), methoxychlor (< 17.6 to 18.2J µg/kg [08_PCB3 at 2 feet]), PCB Aroclor 1248 (< 34.2 to 17,800 µg/kg [08_RE2 at 0 feet]), PCB Aroclor 1254 (< 34.2 to 20,400 µg/kg [08_RE2 at 0 feet]), PCB Aroclor 1260 (< 33.6 to 599J µg/kg [08_ST3 at 0 feet]); and
- fuel and petroleum hydrocarbons: TFH-diesel (< 12.7 to 1,060 milligrams per kilogram (mg/kg) [08_PCB1 at 0 feet]), TFH-gasoline (< 0.052 to 2.26 mg/kg [08_GN2 at 0 feet]), TRPH (< 20 to 7,730 mg/kg [08_ST3 at 0 feet]).

### *Subsurface Soil (greater than 10 feet below ground surface)*

- metals: aluminum (1,540 to 21,600 µg/kg [08_25B204 at 25 feet]), barium (17.2B to 249 µg/kg [08_25B205 at 20 feet]), cadmium (< 0.25 to 4.1 µg/kg [08_25B205 at 20 feet]), copper (1.6B to 12.3 µg/kg [08_25B203 at 20 feet]), lead (0.71 to 8.5 µg/kg [08_25B205 at 20 feet]), mercury (< 0.02 to 0.19 µg/kg [08_DB202 at 10 feet]), nickel (< 1.6 to 31.2 µg/kg [08_25B205 at 20 feet]), zinc (6.6 to 60.2 µg/kg) [08_25B204 at 25 feet], and 15 other TAL metals;
- VOCs: 2-hexanone (< 10 to 8J µg/kg [08_25B206 at 5 feet]), acetone (< 10 to 210 µg/kg [08_25B203 at 10 feet]), carbon disulfide (< 10 to 3J µg/kg [08_25B205 at 10 feet]), methylene chloride (< 10 to 6J µg/kg [08_25B206 at 15 feet]), toluene (< 10 to 5J µg/kg [08_25B206 at 25 feet]);
- SVOCs: benzyl butyl phthalate (< 680 to 400J µg/kg [08_DB202 at 55 feet]), bis(2-ethylhexyl)phthalate (< 680 to 900 µg/kg [08_DGMW73 at 60 feet]);

- pesticides and PCBs: endosulfan sulfate (< 3.56 to 0.911J µg/kg [08_25B206 at 25 feet]); and
- fuel and petroleum hydrocarbons: TFH-diesel (< 12.8 to 39.1 mg/kg [08_25B204 at 10 feet]), TFH-gasoline (< 0.052 to 2.4 mg/kg [08_25B205 at 25 feet]), TRPH (< 20 to 596 mg/kg [08_DB202 at 10 feet]).

### *Groundwater (08_UGMW29 upgradient)*

- general chemistry: nitrate/nitrite-N (11.5 to 11.7 milligrams per liter [mg/L]) total dissolved solids (TDS) (847 to 963 mg/L);
- metals: nickel (134 to 246 micrograms per liter [µg/L]), arsenic (< 0.7 to 2.5B µg/L), and 10 other TAL metals; and
- VOCs: chloroform (< 1 to 0.8J µg/L), toluene (< 1 to 0.7J µg/L), trichloroethylene (12 to 20 µg/L), xylenes (< 1 to 1J).

### *Groundwater (08_DGMW73 and 08_DGMW74 downgradient)*

- general chemistry: nitrate/nitrite as N (12.6 to 15.4 mg/L [08_DGMW73]) and TDS (804 to 961 mg/L [08_DGMW73]),
- metals: arsenic (1B to 2.7B µg/L [08_DGMW74]), nickel (122 to 176 µg/L [08_DGMW73]), and 14 other TAL metals; and
- VOCs: 1,1,2-trichloroethane (2 to 3 µg/L [08_DGMW73]), 1,1-dichloroethene (3 to 8 µg/L [08_DGMW73]), benzene (< 1 to 0.3J µg/L [08_DGMW73]), carbon tetrachloride (0.7J to 6 µg/L [08_DGMW74]), chloroform (6 to 9 µg/L [08_DGMW73]), methyl chloride (0.4J to 6 µg/L [08_DGMW74]), tetrachloroethane (5 to 8 µg/L [08_DGMW74]), trichloroethylene (100D to 140D µg/L [08_DGMW73]).

J = Indicates an estimated value for qualitative use only (organic parameters).

B = Indicates reported value is less than the contract-required detection limit (CRDL), but greater than the or equal to the instrument detection limit (IDL) (inorganic parameters).

D = The value for this compound is from a diluted analysis.

PRGs and ecological screening criteria were compared with corresponding the analytical data obtained from this site (Jacobs Engineering 1993c).

- benzo(a)pyrene, dieldrin, Aroclor 1248, PCB Aroclor 1254, and PCB Aroclor 1260 exceed PRGs, and benzo(a)pyrene, 4,4'-DDE, PCB Aroclor 1254, lead, and zinc exceed ecological screening criteria in Stratum 1;
- no COPCs detected exceed PRGs or ecological screening criteria in Stratum 2;
- PRGs and alpha chlordane, dieldrin, PCB Aroclor 1254, aluminum, barium, cadmium, copper, lead, mercury, and zinc exceed ecological screening criteria in Stratum 3;

- dieldrin, PCB Aroclor 1254 and 1260 exceed PRGs and dieldrin, DDE, and PCB Aroclor 1254 exceed ecological screening criteria in Stratum 4; and
- no COPCs detected exceed PRGs in Stratum 5, and ecological screening criteria were not evaluated.

Groundwater samples were collected from two groundwater monitoring wells (08_UGMW28 and 08_DBMW69) constructed near Site 8. COPCs detected in groundwater samples were compared to PRGs and MCLs:

- 1,1-dichloroethene, 1,1,2-trichloroethane, carbon tetrachloride, tetrachloroethane, trichloroethylene, arsenic, and nitrate/nitrite-N in groundwater exceed PRGs and 1,1-dichloroethene, carbon tetrachloride, tetrachloroethane, trichloroethylene, arsenic, nickel, nitrate/nitrite-N, and TDS in groundwater exceed MCLs in upgradient well (08_DGMW73);
- 1,1-dichloroethene, carbon tetrachloride, tetrachloroethane, trichloroethylene, arsenic, and nitrate/nitrite-N in groundwater exceed PRGs and carbon tetrachloride, tetrachloroethane, trichloroethylene, nickel, nitrate/nitrite-N, and TDS in groundwater exceed MCLs in downgradient well (08_DGMW74); and
- trichloroethylene, and nitrate/nitrite-N in groundwater exceed PRGs and trichloroethylene, nickel, nitrate/nitrite-N, and TDS exceed MCLs in upgradient well (08_UGMW29).

Petroleum hydrocarbons detected in shallow soil samples were compared to the California Leaking Underground Fuel Tank (LUFT) Field Manual guidelines (LUFT 1989) to evaluate their potential to migrate to the groundwater. Based on the LUFT guidelines, TFH-diesel in Stratum 4 shallow soil may pose a threat to groundwater. No other compounds detected in subsurface soil were found to have the potential to reach the groundwater (Jacobs Engineering 1993c).

## U.S. EPA AREAL PHOTOGRAPH SURVEY

The U.S. EPA photographic survey initially noted staining and refuse piles within the western section of the current storage yard (Stratum 2) on the 1952 photograph. Over time, the refuse piles were seen primarily in the central portion of the western section of the storage yard (Stratum 3). Stains were noted throughout the entire current storage yard area but were concentrated predominantly in the eastern portion. Drums were identified on the 1970 and 1991 photographs. Stains were also observed in the 1965 and 1970 photographs in the old salvage yard (Stratum 5). In the 1986 photograph, the old salvage yard was covered with several feet of fill soil and was being used as a parking lot for Building 800.

## SCIENCE APPLICATIONS INTERNATIONAL CORPORATION AREAL PHOTOGRAPH SURVEY

Stains in the northeastern portion of the current storage yard were noted on a 1968 photograph. On the 1979 photograph, the southeastern portion of the yard also appeared to be stained. Persisting stains were seen in the old salvage yard on photographs dated 1961 and 1964. Stains in the northwestern corner of the eastern storage yard (Stratum 1) were also apparent on a photograph from 1983 (SAIC 1993).

## EMPLOYEE INTERVIEWS

On 26 May 1994, a meeting was held at the MCAS El Toro to interview active and retired personnel from the Station Fuel Operations Division and Facility Management Department (currently the Installations Department) with knowledge of the Stations operations and the procedures for the storage/disposal of hazardous materials and waste. Participating as interviewers during the meeting were agency personnel, Navy and Station personnel, and personnel contractors for the Navy and U.S. EPA. During these interviews, the following information pertaining to Site 8 was obtained (Jacobs 1994b).

- Mr. J. Kormos (retired after working for 46 years in the Facilities Management Department, [FMD]) recalled an incident when the FMD excavated the soil near Site 8. Oil was present in the excavation pit; he then believed the oil leaked from tanks at Building 314 and may have migrated across the street. However, in a follow-up conversation between J. Kormos and D. Hernandez of Jacobs Engineering on 17 June 1994, J. Kormos said that waste oil was commonly stored in the DRMO Storage Yard located adjacent to the excavation area. He said spills were common in the storage yard, and it was likely that the oil encountered during excavation activities originated from this activity rather than from the tanks at Building 314.
- E. Silva (retired after working for 41 years in the Facility Management Department) recalled that the storage area was unpaved for a long time, and on numerous occasions, contained dark, oily soil. E. Silva specifically remembered excavating "contaminated" soil from the site and transporting the soil to IR Program Site 2 and replacing it with new "clean" soil.
- The panel members said that different types of equipment were stored at the DRMO Storage Yard, as well as equipment from other installations because it was a regional facility. Solvent spills frequently occurred at the storage yard. D. Campbell (actively working for Planning & Estimating for 22 years) added that the Marines may have stored small quantities of radium-painted parts and gauges at this storage yard.

## SOIL GAS SURVEY

In 1994, a soil gas survey was conducted for Sites 24 and 25 in the southwest quadrant of the MCAS El Toro. The sources of VOC groundwater contamination are believed to be located in this area of the Station. During this investigation, both soil gas and soil samples were collected from approximately 15 and 30 feet bgs in 465 locations. Soil gas samples were analyzed for VOCs, total petroleum hydrocarbons (TPH), and benzene, toluene, ethylbenzene, and xylenes (BTEX); soil samples were analyzed for VOCs.

During this investigation, approximately 25 sampling locations were positioned within and adjacent to Site 8 boundaries. The analytical results of the soil gas samples locations indicated the presence of trichloroethylene, 1,1-dichloroethane, 1,1-dichloroethene, and carbon tetrachloride. The VOCs detected at Site 8 will be investigated and evaluated as part of the Site 24, VOC source investigation (Jacobs Engineering 1994c).

## Geology

The geology of Site 8 consists of Quaternary alluvial and marine deposits (Jacobs Engineering 1993c). Holocene deposits consist of a matrix of fine-grained overbank deposits and some coarse-grained stream channel deposits. These soils are derived from the Santa Ana Mountains to the east and conformably overlie Pleistocene interbedded fine-grained lagoonal and near-shore marine deposits. Pleistocene deposits could not be differentiated from Holocene deposits in Phase I RI soil borings. Pleistocene deposits unconformably overlie semiconsolidated marine sandstones, siltstones, and conglomerates of late Miocene to late Pliocene, which are considered to be bedrock in the area.

Based on a review of boring logs from the Phase I RI, the subsurface lithology at Site 8 consists of sandy lean clay, sandy silt, and poorly graded fine sand.

## Hydrogeology

MCAS El Toro lies within the Irvine Groundwater Basin, which is a subbasin of the Los Angeles groundwater basin. Regional aquifers in the Irvine Subbasin tend to be composed of discontinuous lenses of clayey and silty sands and fine-grained gravels contained within a complex assemblage of sandy clays and sandy silts. Three general aquifer systems have been identified near the Station: a shallow and perched system, a principal aquifer zone, and a lower hydrogeologic system existing in bedrock (Jacobs Engineering 1993c).

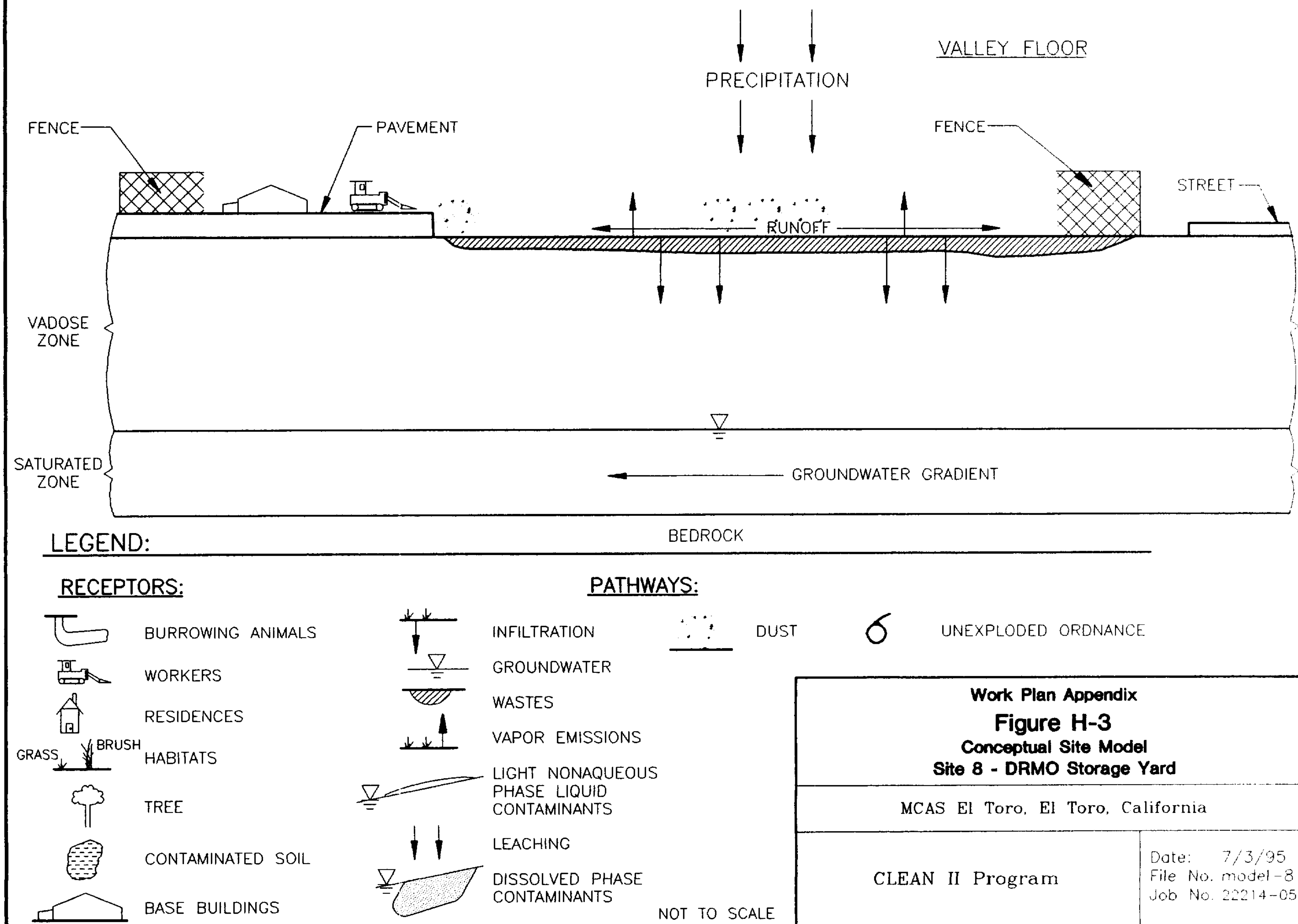
The Phase I RI results indicate that the shallow, perched zone is not present at Site 8. The principal aquifer, 120 feet beneath Site 8, is the main water-producing zone for the Irvine area. The regional groundwater flow direction in the area of the site is generally to the northwest. The local hydraulic gradient has been influenced strongly by the pumping of irrigation wells located west of MCAS El Toro.

## Conceptual Site Model

In the process of developing a conceptual site model, release mechanisms and potential sources of contamination were considered and evaluated to determine their applicability to the site. Also considered in the development of the conceptual site model were potential receptors and contaminant pathways to potential receptors. Figure H-3 illustrates the conceptual site model developed for the site. Figure H-4 depicts the potential exposure routes and pathways for human and ecological receptors.

Continue






**Work Plan Appendix**

**Figure H-3**

**Conceptual Site Model**

**Site 8 - DRMO Storage Yard**

MCAS El Toro, El Toro, California

CLEAN II Program

Date: 7/3/95
File No. model-8
Job No. 22214-059